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MINISTRY OF ENERGY

الإمارات العربية المتحدة
وزارة الطاقة

UAE STATE OF ENERGY REPORT 2015



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“The UAE is striving to develop and boost its rich resources and expertise in the international energy markets and enhance its leading role as a world centre for renewable energy research and development.”

HIS HIGHNESS SHEIKH KHALIFA BIN ZAYED AL NAHYAN

PRESIDENT OF THE UNITED ARAB EMIRATES



> We recognize that preserving our energy resources will be one of the greatest challenges in our drive towards sustainable development. This, however, will not materialize unless the different facets of our society adopt energy conservation principles in their core values. The future generations will be the chief beneficiary of our achievements and the best judge of what we accomplish in this field.

HIS HIGHNESS SHEIKH MOHAMMED BIN RASHID AL MAKTOUM

VICE PRESIDENT AND PRIME MINISTER OF THE UNITED ARAB EMIRATES AND RULER OF DUBAI



WELCOME TO THE FIRST EDITION OF THE UAE STATE OF ENERGY REPORT.

The discovery of oil brought tremendous prosperity to our nation and while we continue to rely on such energy resources, we have also come to realise that we need to re-think our energy mix to ensure continued progress.

The country has already taken many steps towards diversifying energy supply, ensuring its reliability in the future and encouraging the efficient use of resources. Clean energy is both our strategic focus and our mission. Our leadership is keenly aware of the importance that energy and water generation has in ensuring the continued growth of our economy, providing sustainable infrastructure and assisting in the development of productive green industries.

This report is written testament to this commitment and provides an open forum for discourse and knowledge-sharing, an extension of the UAE's engagement on the international stage in discussions on emission-reduction commitments and ways of addressing the issue of climate change.

The UAE was the first Gulf country to embark on a new energy journey – one that includes nuclear power and solar energy, in addition to natural gas, which covers the majority of our needs. We are already reaping the benefits of this decision. Today, we are the first Gulf country to have significant solar-power generation capacity and soon, peaceful nuclear-energy capacity. We are also developing local expertise in these important technologies, resulting in technological advances that we aim to outline and share through this report in the chapter on Energy Diversification and Innovative Technologies.

The country has also initiated pioneering policy approaches to encourage efficiency. These approaches include green building rules and standards for electrical appliances and demand-side management initiatives. The Ministry of Energy is encouraging these efforts through drafting a federal energy policy that aims to ensure the energy sector will continue to support our economy, as outlined in the introduction chapter on the State of Energy.

We have delineated the most recent developments, commitments and initiatives in each of the above areas in the following chapters. In the process, we have actively engaged dignitaries, experts and thought leaders from across the UAE to compile a report that is a true multi-stakeholder body of work, reflecting all of the facets of our thriving energy sector. While this publication has been led by our Ministry, we have received strong support from federal and local government, notably from the Ministry of Foreign Affairs headed by Dr. Thani Al Zeyoudi, the Ministry of Environment and Water, and the United Nations Development Programme through its UAE country office and the Energy and Climate Team in the New York headquarters.

We are proud to present the results of our work and remain committed to progress in this area.

HIS EXCELLENCY SUHAIL MOHAMED FARAJ AL MAZROUEI

MINISTER OF ENERGY, UAE



BAN KI-MOON

SECRETARY-GENERAL OF THE UNITED NATIONS

> Climate change is the defining issue of our time. The effects are already widespread, costly and consequential - from the tropics to the poles, from small islands to large continents, and from the poorest countries to the wealthiest. If we do not take urgent action, all our plans for increased global prosperity and security will be undone.

ON THE OCCASION OF THE ABU DHABI ASCENT (UNITED ARAB EMIRATES), 5 MAY 2014



We are pursuing a strategy of resilience that commits us to research and development, investment in technology, fostering greater international cooperation, and above all, resource conservation. It is through this diversified long-term strategy that the UAE is building the knowledge and human capital required to create sustainable solutions for the resource challenges we face.

HE DR. SULTAN AL JABER
UAE MINISTER OF STATE AND CHAIRMAN OF MASDAR

UAE Government institutions, together with businesses and non-governmental organizations, are working to reduce the emissions on a voluntary basis and taking important steps to reduce climate change impact. The UAE aims to utilize clean energy, enhance energy efficiency, increase the renewable energy share and employ sustainable transportation.

HE DR. RASHID AHMAD BIN FAHAD
MINISTER OF ENVIRONMENT AND WATER





DEAR READER,

Thank you for taking the time to read the State of Energy Report 2015, which supports the visionary policies of HH Sheikh Khalifa bin Zayed Al Nahyan, President of the UAE, and HH Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, to realise the UAE Vision 2021 to raise the UAE to become one of the most competitive nations in capabilities and smart services, and thereby rank our nation as one of the most advanced, developed and happiest countries in the world by 2021. This report outlines the strategy and progress of the Dubai Supreme Council of Energy, the governing body that drives the legislation and strategy of Dubai's energy sector.

Dubai's energy strategy is based on the Dubai Integrated Energy Strategy 2030. This strategy aims to secure uninterrupted supplies of energy, enhance the efficiency and effectiveness of managing demand for electricity and water to achieve leadership in public utilities services, and promote sustainable living and development.

This strategy aims to place Dubai at the forefront globally in terms of sustainability, focusing on efficiency, rationalisation of resources, and preservation of the environment. By 2030, the Supreme Council of Energy intends to achieve a 30% reduction in energy and water demand, and has created a roadmap for demand management spanning from 2013 to 2030, which includes several programmes for the efficient use and re-use of water.

The Dubai Integrated Energy Strategy 2030 is also aligned to the Green Economy for Sustainable Development initiative, introduced by HH Sheikh Mohammed bin Rashid Al Maktoum. As a result, the Supreme Council of Energy actively promotes programmes to enhance the efficiency and reliability of clean and renewable energy to preserve our precious natural resources, protect the environment, and achieve sustainable development in Dubai.

The UAE State of Energy Report 2015 is a comprehensive work plan and guide that includes all of the details related to Dubai's energy sector, along with recent updates, with a special focus on the successes achieved, which has given Dubai the potential to become a role model for social, economic, and environmental development across the Arab World.

While we have made several remarkable achievements, we remain steadfastly committed to making many more to meet the aspirations of our leadership through hard work and unwavering commitment.

HE SAEED MOHAMMED AL TAYER

VICE CHAIRMAN OF THE DUBAI SUPREME COUNCIL OF ENERGY

The UAE has been fortunate with its abundance of oil and gas reserves, but times are changing and there has been a dramatic shift towards a green economy. It makes sense, given the environmental, socioeconomic and financial benefits that can be sustained through this alternative focus. The growth of the population, both locally and globally, is resulting in a constantly growing demand for finite energy resources, placing strain on the environment. It is clear change is needed.

This change is multi-faceted, impacting every industry, as well as the future development of the nation. There is a focus on reducing greenhouse gas emissions, particularly in the power and water industry, and efficiency has become the new buzzword. Rising fossil-fuel demand has created a sense of urgency in the development of alternative energy sources, resulting in significant developments in the way fossil fuels are extracted and used, the development of low carbon generation technologies such as solar and nuclear energy programmes, and innovative, environmentally-friendly projects such as waste-to-energy.

This green shift is also being felt in the transport sector, where innovation is taking the form of biofuel and green fuel development, including Compressed Natural Gas, hybrid and electric vehicle use in commercial applications, increasing public-transport options and electric-car charging stations for public use.

While the infrastructure in the UAE is well-developed, ranked among the best in the world by a recent World Economic Forum report, development continues at a fast pace to cater for the nation's rapidly expanding population. The UAE leadership recognises that this expansion must be green, to ensure a healthy, happy environment and population.

HE DR. MATAR HAMED AL NEYADI

UNDERSECRETARY OF THE UAE MINISTRY OF ENERGY



TABLE OF CONTENT

CHAPTER 1
STATE OF ENERGY AND VISION 2021

Energy Sector 2021, HE Eng. Fatima Al Foora Al Shamsi
The Ministry of Energy Profile
MOENR Infographics
UAE National Agenda
Interview: HE Suhail Al Mazrouei
The UAE Energy Mix, Eng. Ahmed Al Awadi, Hannes Reinisch
Interview: HH Sheikh Ahmed Bin Saeed Al Maktoum
UAE Carbon Intensity, Eng. Meshayel Lehsooni and Eng. Sommayah Alyammahi
A Global Team Player, Dane McQueen
Interview: HE Ahmed Al Muhairbi
Vision 2021
Energy Events Calendar UAE 2014/2015
Supporting International Negotations, Tina Latif
Interview: HE Abdulla Kalban
Energy Water Nexus, Mohammed Al Madfae et al.
Water in Islam
Energy Efficiency, Dr. Rashid Al Shaali
Emirates National Grid, Mohammed Awad
Energy Efficiency in the UAE, Michael Sachse
The Carbon Ambassadors
Energy Awards in the UAE

CHAPTER 2
CLEAN AND RENEWABLE ENERGY

Clean Energy in UAE, HE Waleed Salman
Interview: HE Saeed Al Tayer
Renewable Energy Exported, Dane McQueen
Renewable Energy in UAE, Deger Saygin, Sgouris Sgouridis
Al Qusais Landfill
Way Forward for Renewables, Tanzeed Alam
Striking the Golden Balance, Richard Slark
Arab Renewable Energy Strategy, Mustapha Taoumi and Ali Alshehhi
Shams 1 Solar Power Plant
Setting a Place for the Sun, Tabaré A. Currás
UAE's Solar Power
UAE Energy Water Nexus, Dr. Steven Griffiths
Sparking Innovation

CHAPTER 3
FUELS, INFTRASTRUCTURE AND INDUSTRY

UAE Oil and Gas, Dr. Saif Sultan Al Nasseri
Reducing Transport's Environmental Impact, Waddah Ghanem, Alia Busamra
Let's Talk Sustainability, Hadi Al Badi
CNG fuel, Dr. Saif Sultan Al Nasseri
Innovation for Sustainable Fuel, Saeed Khoory
Sour gas Projects, Dr. Saif Sultan Al Nasseri
Shrinking the footprint
Integrated Gas Distribution System
Power for the People. TAQA
Biofuel, Yousif Lootah
The Hybrid Taxi, Ahmed Khalfan Al Suwaidi
Harnessing Free Energy, Tayeb Al Awadhi
Waste Revisited, Martti Surakka

CHAPTER 4
ENERGY EFFICIENCY, DSM, & GREEN CITIES

Energy Efficiency in the UAE , Dr. Nawal Al Hosany
Interview: Saeed Alabar
Greening Exsiting Buildings
UAE Demand Side Response, Joni Tefke
Turning One - Super Esco, Stephane le Gentil
The Dubai ESCO Accreditation, James Grinnell
Managing Demand Through Education, Ramiz & Khadija
The Conservation Award
The Value of Smart Grid, Dan Yates
Cooler by Design, Graeme Sims
Ajman Green Building Committee
Interview: Dan Yates
Maintaining Smart Cities, Simon Roopchand
Towards a Carbon-Freezone, Muammar Al Katheeri
Ambassadors of Sustainability, Dubai Municipality
Emission Reduction Programs, Tamara Withers
Lighting Standard Infographic
Labelling Success, Abdullah AlMaeeni
EcoCities Builders Summit, Ahmed Baharoon

CHAPTER 5
ENERGY DIVERSIFICATION AND INNOVATIVE TECHNOLOGIES

Energy Diversification in the UAE, HE Mohamed Al Hammadi
Natural Gas, Ibrahim Al Ansari
Mohammed bin Rashid Al Maktoum Solar Park, DEWA
Carbon Capture in the UAE, Paul Crooks
Food Waste Disposal, Mohamad Karam
UAE's greatest Energy Resource, Alex Lesky
WETEX 2014, DEWA
Hassyan Clean Coal Power, DEWA

CHAPTER 6
TRANSPORT AND MOBILITY

Transport and Mobility in the UAE, Eng. Faris Saif Al Mazrouei
Environmentally Friendly Rail Network, Eng. Faris Saif Al Mazrouei
Interview: HE Mattar Al Tayer
Energy Efficiency of Dubai Metro, Abdullah Al Ali
Interview: HE Mohammed Abdullah Al Jarman
Energy Efficient Public Transport, Dr. Yousif Al Ali
Electric Vehicles in the UAE, Dr. Amro Farid
Electric Car Charging Stations, DEWA
Significant Years for Aviation Industry, Linden Coppell
Emirates Transport and CNG, Amer Al Harmoudi
Dubai Sustainable Street Lighing program, Eng Maitha bin Adai

CHAPTER 7
CLIMATE CHANGE

UAE and Climate Change, Dr. Thani Al Zeyoudi
UAE Green Growth Strategy, Dr. Aisha Al Abdooli
Overcoming Our Resource Challenges, HE Sultan Al Jaber
UAE GHG Inventory Infographic
UAE GHG Inventory, Poala Ferreira
GHG Emissions Estimation Methodologies, Eng. Meshayel Lehsooni, Reshma Francy,
Interview: Adnan Z. Amin
Creating an Environment for Efficiency, Eva Ramos et al.
GHG Emissions Energy Planning, Clemens Ploechl, Reshma Francy
Decarbonizing the UAE Economy, Ivano Iannelli
The Climate Change Programme, Ahmed Baharoon
Blue Carbon, Ahmed Bahroon
DEWA's Emissions Reduction, DEWA
Sustainability in Aluminium Industry, Saeed Al Mazrooei
Decreasing the Carbon Footprint, Feryal Tawakul
Global Coalition for Green Schools, Aanal Patwari

01

STATE OF ENERGY & VISION 2021

HIS EXCELLENCY

ENG. SUHAIL MOHAMED FARAJ AL MAZROUEI

MINISTER OF ENERGY, UAE



Over the past decade, securing a stable and affordable energy supply has become a significant global issue. Volatility and the high prices of hydrocarbon fuels have prompted many governments to reconsider their energy options.

Concern over the environmental impact of certain types of energy generation has led decision makers to choose new energy technologies and driven policy changes in the sector.

This is also true for the UAE. Although the country is well-endowed with hydrocarbon resources, it is also diversifying its supply options and placing increasing importance on how energy use is managed, guided by new legislation.

Among these initiatives is the effort spearheaded by our Ministry of Energy to draft a federal energy policy. We are consulting with various stakeholders to arrive collectively at a vision of what our energy future should look like. Ultimately, this effort is about ensuring the continued prosperity of our people, which is the top priority for our leadership, in line with the ambitious National Agenda – Vision 2021.

This milestone strategic document outlines the UAE's aspirations to produce almost one quarter of the nation's energy requirements from clean sources and decrease water scarcity. The relevant plan of action will also affect a variety of the additional goals of Vision 2021, including job creation for Emiratis in the public and private sector, non-oil real GDP growth, increasing the share of knowledge workers in the labour force and more.

The UAE has developed an integrated, ambitious plan for a more sustainable and stable economy and society for the future. The Ministry of Energy takes great pride in presenting our piece of the puzzle.



THE ENERGY SECTOR ON COURSE FOR 2021

MAIN REPORT

By HE Eng. Fatima Al Foora Al Shamsi

OFFERING THE OPTION FOR A MORE SUSTAINABLE FUEL SOLUTION

The energy sector plays an important role in shaping the UAE's internal and external strategies and policies. Since the discovery of oil and gas more than half a century ago, the UAE has become a central player in the global hydrocarbon energy market, providing a reliable and stable supply of energy. Bloomberg cites the UAE as the fifth-largest oil producer in the Organization of the Petroleum Exporting Countries (OPEC), with an oil output averaging 2.79 million barrels per day (bpd) in 2013, reaching close to 3 million bpd some days, and with production capacity set to rise to 3.5 million bpd by 2017. Market production of natural gas reached 54.60 billion cubic metres in 2013.

The UAE's Oil and Gas in Figures 2013

Proved crude oil reserves million barrels	97,800
Natural gas reserves billion cu m	6,091
Crude oil production 1,000 b/d	2,797
Natural gas marketed production million cu m	54,600
Refinery capacity 1,000 b/cd	707

Source: OPEC Annual Statistical Bulletin 2014



In 2013 approximately 25 per cent of the country's gross domestic product was directly based on oil and gas output, making the export and refinery of hydrocarbon products like petroleum, crude oil, and natural gas the backbone of the UAE economy (according to the CIA World Factbook). This revenue continues to fuel aspects of the UAE's rapid economic and social development, which started in the 1960s and has continued at a speed and to an extent that has impressed the international community and made citizens and residents alike proud to call the UAE home. The United Nations Human Development Index (HDI) ranks the UAE in the very high category.

But this is only one part of the story. As the UAE concluded celebrations of the 40th anniversary of the federal union of the seven emirates in 2011, the country's leaders turned the page to the next chapter: Vision 2021.

The President of the UAE, His Highness Sheikh Khalifa bin Zayed Al Nahyan, and Vice President and Prime Minister of the UAE and Ruler of Dubai, His Highness Sheikh Mohammed bin Rashid Al Maktoum, have outlined and defined the UAE Vision 2021 in order to accelerate development and elevate the UAE to the international top rankings in the respective categories by 2021, coinciding with the UAE's celebration of its union's golden jubilee. The strategy document sets ambitious and defined performance indicators and targets for the major areas of national development.

HH Sheikh Mohammed Bin Rashid Al Maktoum specified that the UAE strives for: "Firstly, ambitious, confident people who respect and value their heritage; secondly, a strong union with a common destiny; thirdly, a competitive economy led by UAE Nationals characterised with innovation and knowledge; and fourthly, high quality of life endowed with a sustainable environment".

> As the UAE concluded celebrations of the 40th anniversary of the federal union of the seven emirates in 2011, the country's leaders turned the page to the next chapter: Vision 2021.

UAE Vision 2021 Key Pillars



Within Vision 2021, the UAE Cabinet announced that people are at the core of development, not fossil fuels.

The idea is not a new one. The late Sheikh Zayed Bin Sultan Al Nahyan recognised that the UAE should not only rely on oil, but must also diversify sources of revenue and construct economic projects that will ensure a free, stable and dignified life for the people. But the determination and speed with which the country is moving forward, and the extent to which government entities are being made accountable is a recent positive development.

This applies equally to the energy sector, where a sustainable and diversified economy is fuelled by an equally sustainable mix of energy sources. The innovation required will also help the transition to the competitive knowledge economy we are aiming for. The infrastructure to produce energy and water sustainably for residential consumption will need to meet world-class standards. The quality of life in the UAE will naturally improve due to the availability of energy-efficient housing and transport.

As a means to achieve the UAE Vision 2021 in time, the government announced a seven-year National Agenda in January 2014. For the Ministry of Energy to achieve the energy sector targets, the UAE needs to generate 24 per cent of the energy requirements within its energy mix from clean energy sources, reduce its per capita greenhouse gas emissions, and achieve energy intensity of 5 tonnes of oil consumption per capita by 2021. There is still some way to go to reach these goals.

The UAE Energy and Water Profile (based on the annual statistics report by the UAE Ministry of Energy)
The increasing demand for energy and water is a defining feature of the UAE energy sector, requiring a corresponding increase in production. Between 2008 and 2012, installed electricity capacity grew by 37 per cent, with Dubai increasing capacity by 44.5 per cent and Abu Dhabi by 43.6 per cent. In 2012, the total installed capacity in the country reached 27,180 megawatts (MW).

Energy demand has increased significantly, in line with the GDP – 49.7 per cent for Abu Dhabi Water and Energy Authority (ADWEA) and 25.8 per cent for Dubai Electricity and Water Authority (DEWA) between 2008 and 2012. It is worth noting that Abu Dhabi exports electricity and water to Sharjah and the Northern Emirates, with the amount nearly doubling from 2008 to reach a total of 13,664 gigawatt hours (GWh) of exports. Overall, the total electricity consumed within the country reached 101,454GWh in 2012. Peak loads grew by 31 per cent between 2008 and 2012.

The water consumed in the UAE is mainly desalinated, dependent on electricity in the case of reverse osmosis (RO), or as a by-product of electricity generation through multiple-effect distillation (MED) and multi-stage flash distillation (MSF). Demand for water has been growing rapidly, namely at a rate of 35.8% from 2008 to 2012. In 2012, the installed capacity for desalinated and ground water reached 1,585 million imperial gallons per day, while water production was 393,878 million imperial gallons per year.

The pricing structure in the UAE varies depending on the utility, with electricity being the cheapest from ADWEA at 15 fils per kWh for residential, commercial and industrial customers, up to 40 fils per kWh for industrial customers of the Sharjah Electricity & Water Authority (SEWA) and Federal Electricity & Water Authority (FEWA). Water starts at one fil per gallon from ADWEA, and up to 4.6 fils per gallon for high-consumption users from DEWA, which has a slab tariff depending on the amount of water consumed.

Currently, like the vast majority of countries, the UAE relies on fossil fuels for most of its energy needs and energy security is at the top of the government's agenda.

Energy Security and the Export Potential of Natural Gas

Contrary to popular belief, the energy that fuels the country's rapid economic development stems from natural gas rather than oil. Gas provides well over 90 per cent of electricity generation and despite the fact that the UAE's natural gas reserves have been estimated as the fifth largest in the world by the US Energy Information Administration, the UAE has been importing the natural gas since 2007. The country receives approximately 2 billion cubic feet of gas per day via the Dolphin Energy pipeline from Qatar, a cross-border refined gas transmission project and the largest energy-related venture undertaken in the region.

Dubai purchases approximately 3 million metric tonnes of LNG a year, with Abu Dhabi also increasing its requirements. In 2012, Mubadala Petroleum and the International Petroleum Investment Company formed a joint venture, Emirates LNG, whose goal was to secure additional gas supplies for the UAE. In February 2013, Emirates LNG signed an agreement with the Government of Fujairah to lease 260,000 square metres of land along the Indian Ocean coastline. According to information from Mubadala, Emirates LNG plans to build a regasification facility capable of importing 1.2 billion cubic feet per day of gas from the international market and an LNG receiving terminal with a capacity of about 9 million tonnes a year, expected in 2018.

The country's ambitious industrial diversification goals mean that overall energy demand will continue to rise. The UAE, especially Abu Dhabi, has significant sour gas reserves but, until recently, tapping them was considered an economically risky and technically challenging option because of the high amounts of corrosive hydrogen sulphide they contain. The expected global, and local, increase in demand for energy resources, as well as the advancement of extraction and processing technologies, has led to Abu Dhabi reconsidering its position.

Currently, Al Hosn Gas, a joint venture between the Abu Dhabi National Oil Company (ADNOC) and the Occidental Petroleum Corporation, is working on the Shah Gas Development in the Liwa Desert of Abu Dhabi. This is the first development of its kind in the UAE and the most complex project undertaken by ADNOC. The facility will process one billion cubic feet of sour gas per day, which, when stripped of sulphur, will produce an estimated 500 million cubic feet of gas per day. Completion of the Shah Gas Development is expected by early 2015.

Additionally, ADNOC is working to develop the Bab Gas Compression project in partnership with Royal Dutch Shell. The project is expected to yield more than 500 million cubic feet of gas per day and is anticipated to come online by 2020. Abu Dhabi is also making important steps to implement carbon capture and storage (CCS) technology locally. This novel technique, which involves capturing carbon dioxide and pumping it to oil fields, was trialed by ADNOC on a small scale at the Rumaitha oil field in conjunction with Masdar. ADNOC is now collaborating with Masdar on a project designed to capture 800,000 tonnes of CO_2 per year from Emirates Steel, located in the Mussafah industrial area in the Capital. The CO_2 will initially be pumped from the plant into the Rumaitha oil field, some 50 kilometres away. Besides preventing the release of greenhouse emissions into the atmosphere, the project will also serve to boost oil production in the field. Currently, hydrogen gas is used to achieve this goal. The project is expected to start as early as 2016.



World marketed production of natural gas by country (million standard cu m)

	2008	2009	2010	2011	2012	% change 12/11
Iraq	1,880	1,149	1,303	876	646	-26.3
Kuwait	12,700	11,489	11,733	13,533	15,515	14.6
Oman	24,082	23,975	27,086	28,595	31,583	10.4
Qatar	76,981	89,300	131,165	145,271	157,050	8.1
Saudi Arabia	80,440	78,450	87,660	92,260	99,330	7.7
Syrian Arab Republic	5,900	6,510	8,940	7,870	6,830	13.2
United Arab Emirates	50,240	48,840	51,282	52,308	54, 308	3.8
Others	1,650	2,180	8,010	12,450	9,190	-26.2

Source: OPEC Annual Statistical Bulletin 2013

We are also increasing hydrocarbon refinery capacity, with ADNOC expanding its capacity in the Ruwais area by approximately 417,000bpd hitting a total capacity of 920,000bpd in the first quarter of 2015. Helping to avoid any shortage of gasoline products, the UAE will reach a capacity of 920,000bpd for ADNOC (2015), 140,000bpd for ENOC and 80,000bpd in Fujairah.

More details can be found in Chapter 3 on Fuel, Infrastructure and Industry.

From this secure position, the UAE is forming a strategy to slow the growth in energy consumption and diversify supply sources through investments in nuclear power, renewable energy and LNG terminals. This will help the country to reduce its reliance on oil and to meet rising energy and water demand. As a response to the visionary National Agenda 2021, the UAE is stepping up its game.



Focus on Energy Diversification and Renewable Energy

In June 2009, Abu Dhabi future energy company Masdar inaugurated a 10MW solar photovoltaic (PV) plant in Masdar City, a low-carbon development on the outskirts of the UAE capital. At the time, the plant was the largest of its kind in the region, which until then had limited deployment on solar power technologies, mainly using solar panels for off-grid applications such as parking meters and street lights, as well as the limited use of solar hot water applications. In addition to PV solutions, Masdar has invested in solar thermal technology. In March 2013, the company officially inaugurated Shams One, a 100MW concentrated solar power (CSP) plant in the Western Region of Abu Dhabi.

Through the Masdar Institute of Science and Technology, Abu Dhabi has also produced the first in-depth assessment of the UAE's potential to harness energy from the sun, focusing on challenges such as high temperatures and the seasonal high volumes of airborne dust, which affect the performance of solar plants. In collaboration with water companies, Masdar is also currently implementing pilot projects to assess the use of solar energy in powering desalination processes – a key priority for the UAE, given its reliance on desalinated water and the significant energy footprint of the desalination process.



> "Between 2008 and 2012, installed electricity capacity grew by 37 percent, (...) the total installed capacity in the country reached 27,180 megawatts (MW)."

Domestic Prices of Petroleum Products in UAE (Year 2013)

Product	Wholesales Prices (Dhs/Litre)	Retail prices (Dhs/Litre)
Unleaded Gasoline 98	1.83	1.83
Unleaded Gasoline 95	1.72	1.72
Gasoline E Plus 91	1.61	1.61
Jet / Kerosene	2.99	
Kerosene	3.18	3.25
Gas Oil / Diesel	**3.05 / *2.30	**3.45 / *2.35
Fuel Oil	2.21	

ADNOC Distribution Prices
*Diesel price in Abu Dhabi
** Diesel price in Northern Emirates

Dubai is also investing in solar power. In October 2013, it launched a 13MW solar PV facility at a site in Seih Al Dahal. Located around 30km south-east of the city, the site is the first development within the Mohammed bin Rashid Al Maktoum Solar Park, which is planned to have a capacity output of 1,000MW by 2030. DEWA released a tender in 2014 for a 100MW PV plant as part of the complex. The emirate has also mandated the use of solar hot water solutions for new large-scale developments as part of a series of green requirements for buildings.

Nuclear power is another important pillar of the UAE energy mix. Abu Dhabi has announced plans to generate 5.6GW of nuclear power by 2020. Currently, the Emirates Nuclear Energy Corporation is building two nuclear reactors at a site in Barakah, in the Western Region of the UAE. Four plants are planned in total, which will provide 5.6GW of low-carbon electricity to the national grid. The first reactor, with a capacity of 1400MW, is scheduled to start commercial operations in 2017, while the second one is scheduled a year later and is pending regulatory approval. The remaining two units are to start operating in 2019 and 2020, respectively. More details are provided in Chapter 2 on Clean Energy and 5 on Innovative Technologies and Innovation.

These investments in renewable and nuclear technology will serve to diversify the energy mix and provide high-calibre jobs for educated UAE nationals, serving an important developmental and social purpose and supporting climate change mitigation. The UAE recognises the importance of reducing carbon dioxide and other greenhouse gases in the atmosphere and is taking measures to reduce its carbon footprint. In May 2013, the Environment Agency – Abu Dhabi launched a detailed greenhouse inventory for the capital, providing an in-depth analysis of the climate change impact of specific industries and sectors. In addition, the Ministry of Environment and Water has mandated that the Dubai Carbon Centre for Excellence (DCCE) conduct a greenhouse gas inventory for the UAE, using the year 2012 as the baseline. The 2013 update is currently being compiled by DCCE on behalf of the Ministry of Energy, which is also managing all national communications under the United Nations Framework Convention on Climate Change (2006, 2010, 2012). Chapter 7 on Climate Change provides the necessary background on this.

While investing in low-carbon energy generation is one way of reducing emissions, another is taking steps towards reducing energy consumption. To this end, the local governments have taken measures to encourage energy efficiency in buildings through legislation, mandatory and voluntary guidelines and other catalysts such as Green Building Codes in Abu Dhabi and Ajman (Estidama). Purpose-built vehicles such as the super ESCO 'Etihad Energy' in Dubai, will also help kick-start the national performance contracting market for energy efficiency in buildings. Chapter 4 elaborates on this.

These developments have been further supported by personnel changes during the restructuring of the UAE cabinet in early 2013. ■

ABOUT HE ENG. FATIMA AL-FOORA AL SHAMSI



She is the Assistant Undersecretary for Electricity in the United Arab Emirates Ministry of Energy. Engineer Fatima worked as the Vice President of the Privatization and Business Development in Dubai Electricity and Water Authority (DEWA) and as an Executive Director for Electricity in the Federal Electricity & Water Authority (FEWA).

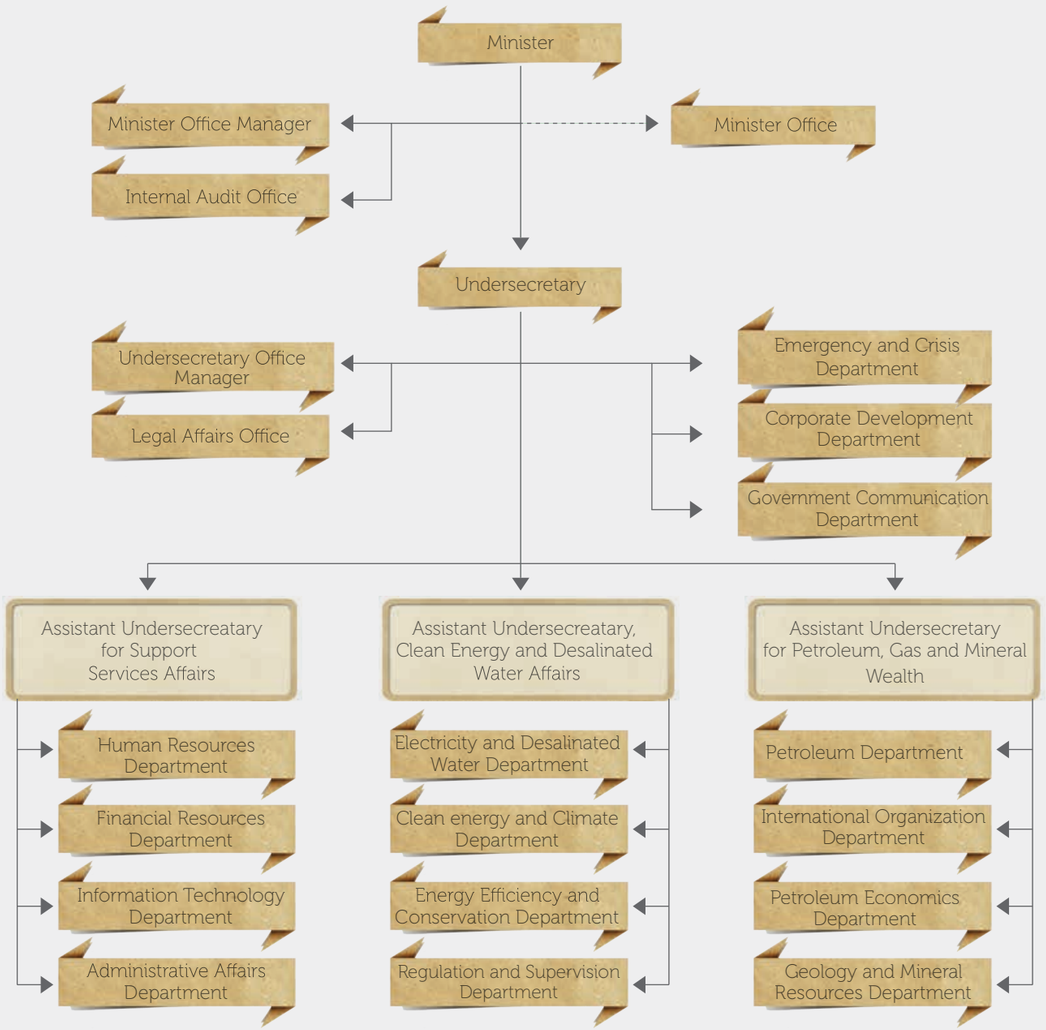


MEET THE NEW MINISTRY OF ENERGY...

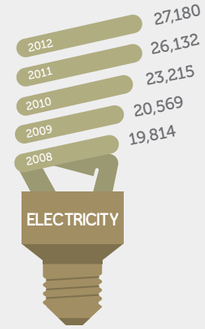
Since 2013, the Ministry of Energy has undergone restructuring to ensure it is better placed to fulfill its new mandate. While the Ministry previously was solely responsible for representing the UAE in the international arena, this is now only one of its responsibilities, with the need to act as a coordinator and regulator of energy policy now taking centre stage.

The changes include the addition of three new departments to the Ministry, among which is the Regulation and Supervision Department, which will be tasked with drafting federal policies in the energy and water sector. A new Energy Conservation and Efficiency Department will work to coordinate the many existing initiatives that various emirates have undertaken to promote the more efficient use of power, especially within the buildings sector. The department will also be responsible for coming up with new initiatives to help reduce energy intensity. Finally, the Clean Energy and Climate Change Department will coordinate efforts related to the promotion of renewable energy, especially solar, which has the best potential in the UAE, and focus on the need to address greenhouse gas emissions at the federal level.

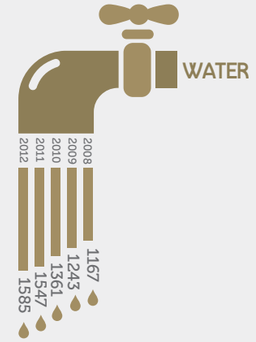
The Ministry will be relying on a substantial number of young, highly educated UAE nationals to achieve its goals. Currently, Emirati nationals form over 80 per cent of the Ministry's workforce. ■



INSTALLED CAPACITY

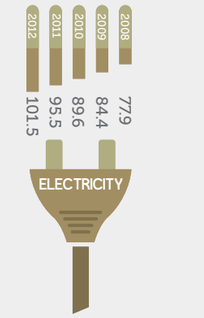


ELECTRICITY INSTALLED CAPACITY - MW



INSTALLED DISALINATION CAPACITY - MIG/DAY

CONSUMPTION



ENERGY CONSUMPTION - TWH

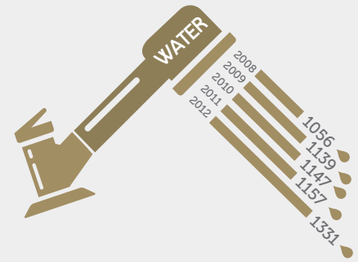


WATER CONSUMPTION - MIG/DAY

PEAK LOAD



PEAK LOAD - GW



PEAK WATER DEMAND - MIG/DAY

Transforming the Power Sector

HE Eng. Suhail Mohamed Faraj Al Mazrouei was sworn in as Minister of Energy in the Cabinet of the United Arab Emirates in March 2013.

As a petroleum engineer, he rose through the ranks until he became the Director of Production and Engineering Facilities for all of the companies operating in the offshore area of Abu Dhabi. He managed and coordinated a collective production of more than one million barrels daily.

From 2004-2005, he was appointed to Shell EP in the Netherlands, where he gained experience in many international projects in Nigeria, North Sea, Brunei and the Netherlands.

During his career in Mubadala, he succeeded in adding new projects to the company's portfolio assets in Bahrain, Oman and Kazakhstan, which increased the value of the company's shares. He was responsible for the development of new projects as well as investments in exploration and production in the Middle East and Africa.

He holds a Bachelor's degree in petroleum engineering from the University of Tulsa in the United States.

VISION 2021: KEY PERFORMANCE INDICATORS

National Agenda UAE Vision 2021

Competitive Knowledge Economy

Non-Oil Real GDP Growth
An indicator that measures the real annual economic growth of all sectors except oil. It is one of the most important macroeconomic indicators and reflects the overall state of the national economy over consecutive years. GDP includes the total value of annual production of goods and services.
Target 5%

Gross National Income (GNI) per Capita
This indicator measures the average income per person in a country. GNI includes the value of all the services and products that have been produced in the country (i.e. GDP) in a given year, in addition to the country's net income from abroad (such as dividends and interest). The UAE aims to increase the GNI per capita by %65.
Target Among the top 10 countries

Net inflow of Foreign Direct Investment as % of GDP
The indicator is measured as foreign direct investment (FDI) as a percentage of GDP. FDI is defined as an investment involving a long term relationship and reflecting a lasting interest and control by a resident entity in one economy in an enterprise resident in an economy other than that of the foreign direct investor. It is the sum of equity capital, reinvestment of earnings, other long-term and short-term capital as shown in the balance of payments.
Target 5%

Global Competitiveness Index
A composite indicator that assesses the competitiveness of countries based on 12 areas: institutions, infrastructure, macroeconomic environment, health and primary education, higher education and training, goods market efficiency, labor market efficiency, financial market development, technological readiness, market size, business sophistication, and innovation.
Target Among the top 10 countries

Ease of Doing Business Index
An indicator that evaluates government procedures around business activity. It is based on 10 sub-indicators: starting a business, obtaining construction permits, registering property, obtaining credit facilities, protection of investors, payment of taxes, cross-border trading, enforcing contracts, resolving insolvency, and obtaining electricity.
Target Rank 1

Share of UAE Nationals in the workforce
The share of UAE nationals employed out of the total workforce (expatriates and nationals), across all sectors.
Target To double the current share

Emiratisation Rate in the Private Sector
An indicator that measures the share of UAE nationals employed in the private sector, as a proportion of the total private sector workforce (expatriates and nationals).
Target To incease the current share tenfold

SME Contribution to Non-Oil GDP
An indicator that measures the share of GDP produced by small and medium-sized enterprises.
Target 70%

(Global Entrepreneurship and Development Index (GEDI
An indicator that measures 3 sub-indices: entrepreneurial attitudes (the general disposition of a country's population toward entrepreneurs, entrepreneurship, and business start-ups), entrepreneurial activity (the startup activity in the medium- or high-technology sector initiated by educated entrepreneurs in response to business opportunities in a somewhat competitive environment), and entrepreneurship aspiration (the efforts of the early stage entrepreneur to introduce new products and services, develop new production processes, penetrate foreign markets, substantially increase the number of firm employees, and finance the business with either formal or informal venture capital, or both).
Target Among the top 10 countries

Global Innovation Index
A composite index that measures the performance of innovation in countries. Innovation inputs are measured based on institutions, human capital and research, infrastructure, market sophistication, and business sophistication, while innovation output is measured by knowledge and technology outputs, and creative outputs.
Target Among the top 20 countries

Share of "Knowledge Workers" in the labor force
The share of highly skilled workers, workers in high-level professions, and workers classified under the International Standard Classification of Occupations (ISCO - 08) of the total workforce. These jobs include: legislators, managers, business executives, and specialists and technicians in the scientific, technical and humanitarian fields.
Target To double the current share

Research and Development Expenditure as % of GDP
A measure of the total domestic expenditure on research and development (in the public, academic, and private sector), as a percentage of GDP.
Target To triple the current value

Sustainable Environment and Infrastructure

Air Quality Index
This indicator is a daily measure of the quality of air, in terms of pollution and the negative effects it may have on human health.
Target 90%

Share of treated waste of total waste generated
This indicator measures the percentage of treated waste out of the total generated waste (solid waste) using various treatment methods (recycling, incineration, waste-to-energy, chemical treatment, except for the landfill), in line with the methodology used by the OECD.
Target 75%

Share of clean energy contribution
This indicator measures the contribution of clean energy sources (renewable, nuclear) to the total energy mix.
Target 24%

Water scarcity index
This indicator represents water overuse by measuring fresh water usage (including and surface water, renewable water and fossil water) as a percentage of overall renewable water in the UAE. The result is weighted to take into account desalination and waste water treatment.
Target Ratio of 4.0

Networked Readiness Index (Telecommunication & IT sectors)
This composite indicator measures the readiness of a country to capture opportunities provided by information and communication technology to increase competitiveness based on four main factors: Environment (The regulatory environment for information and communication technology and the environment for business and innovation), Readiness (Infrastructure for information and communication technology and availability of expertise / skills), Usage (Use of ICT by individuals, businesses, and government), Impact (The economic and social impact of information and communication technology).
Target Among the top 20 countries

Quality of air transport infrastructure
The indicator measures the overall level of infrastructure at airports in the country through a global survey and its adherence to international standards.
Target Rank 1

Logistics performance index
This indicator measures the quality of infrastructure support for logistics activities based on a global survey on the performance of logistics. The survey assesses the effectiveness of border and customs management in terms of simplicity and speed, the quality of trade and transport infrastructure, the ease of shipping at competitive prices, the efficiency and quality of logistics services, the ability to track and trace cargo, and arrival of cargo to destinations on time.
Target Among the top 10 countries

Quality of overall infrastructure (such as transportation, electricity and telephone lines)
This composite indicator measures the overall level of infrastructure based on two main components: the infrastructure for transport and the infrastructure for electricity and telecommunication. The first component assesses the overall level and quality of road networks, air transport infrastructure and port infrastructure, while the second component assesses the quality of electricity supply and telecommunication infrastructure.
Target Rank 1

Quality of port infrastructure
This indicator measures through a global survey the overall level of infrastructure of ports in the country and its adherence to international standards.
Target Rank 1

Online Services Index
This indicator measures the evolution of e-government services (i.e., smart services) in terms of availability, quality and diversity of channels and the use of the public for these services.
Target Rank 1

Time to obtain a loan/house from the Government for UAE nationals
This indicator measures the extent to which the country meets the housing needs of UAE nationals by measuring the waiting time between the date of application for a loan/house and the date of the final approval.
Target 2 years from application date

Safe Public and Fair Judiciary

Judicial system efficiency
An indicator measured by the World Bank as part of the "Doing Business" report, which conducts a poll about the effectiveness of enforcing contracts. This indicator is based on three criteria: time needed to resolve a commercial case from its initiation to its resolution, the number of procedures required, and the cost as percentage of the total value of the lawsuit.
Target Among the top 10 countries

Reliability of Police Services
This indicator expresses the opinion of various segments of society about the ability to rely on police services to enforce law and order in the country.
Target Rank 1

Sense of Security
This indicator measures the sense of security residents feel through a questionnaire. The questionnaire covers different segments of society and different geographic locations.
Target 100%
2021

Road Traffic Death Rate per thousand population 100
An indicator that measures the number of deaths resulting from road accidents per 100,000 population annually. The target is to reduce this number to an average of 3 deaths/100,000 population, thereby placing the UAE among the top 5 safest countries in the world according to the World Health Organization rankings
Target 3 deaths per 100,000 population

Cohesive Society and Preserved Identity

Happiness Index
An indicator that measures the opinion of individuals about standards of living and life satisfaction, using a survey to assess the extent that individuals feel happy and satisfied with their lives. It includes factors such as income level (GDP per capita), average life expectancy, social support, absence of corruption, and freedom to make life choices.
Target Among the top 5 countries

National Identity Index
A composite indicator that measures the sense of belonging and national identity of UAE nationals. This index expresses the sense of pride that citizen's feel belonging to the UAE and how it is expressed.
Target 100%

Human Development Index
A composite indicator that expresses the well-being of nations on three dimensions: age (life expectancy at birth), educational attainment (literacy and enrollment rate in primary, secondary and tertiary education), and the standard of living (GDP per capita).
Target Among the top 10 countries

Social Cohesion Index
A composite indicator that measures the extent to which the UAE community adheres to the principles and values of national identity and the social cohesion between the different segments of the community.
Target Work in Progress

Family Cohesion Index
An indicator that measures the social bond between family members. It's main components include family stability, social, and cultural upbringing.
Target Work in Progress

Number of Olympic medals won
An indicator that measures achievements and the number of medals collected in the Olympic and Paralympic championships in various sports.
Target To double the current number of medals

World-Class Healthcare

Number of deaths from cardiovascular diseases
This indicator measures the deaths from cardiovascular disease per 100,000 population.
Target Reduce the current number by 25%

Prevalence of Diabetes
This indicator measures the number of people between the age of 20 and 79 with diabetes in the UAE, as a proportion of the total population. This age group is aligned with the age group used by the International Diabetes Federation).
Target Reduce the current value by 14%

Prevalence of obesity amongst children (17-5 years old)
This indicator measures the proportion of children between the age of 5 and 17 who are considered obese out of the total children of the same age group. Obesity in children is defined as follows: • Children aged 5 to 12: The proportion of children with a BMI greater than 2 standard deviations above the growth standard median • Children aged above 12: The proportion of children with a BMI greater than 30.
Target Reduce the current value by 17%

Average Healthy Life Expectancy
This indicator measures the average number of years that a person can expect to live in full health.
Target 73 years

Prevalence of Smoking
This indicator measures the daily consumption of cigarettes and tobacco products among different segments of society.
Target Reduce the current rate by 15%

Number of deaths from cancer
This indicator measures the deaths from malignant tumors per 100,000 population.
Target Reduce the current number by 18%

Percentage of Accredited Health Facilities
This indicator measures the share of public and private hospitals adhering to national or internationally recognized standards.
Target 100%

Healthcare Quality Index
This indicator measures countries' performance in three areas: basic health outcomes, health infrastructure and preventative care, and physical and mental health satisfaction.
Target Rank 20

Number of physicians per 1,000 population
This indicator measures the average number of physicians per 1,000 population.
Target Increase the current number by 50%

Number of nurses per 1,000 population
This indicator measures the average number of nurses per 1,000 population.
Target Increase the current number by 50%

First-rate Education System

Average PISA Score
An indicator that reflects the country's ranking and scores in the PISA exam, which measures the reading, mathematics and science skills of 15 year old students.
Target Among the top 20 countries

Average TIMSS score
An indicator that reflects the nation's ranking and score in the TIMSS test, which measure the math and science skills of students in grades 4 and 8.
Target Among the top 15 countries

Upper Secondary graduation rate
An indicator that measures the share of national students graduating from secondary education out of the total students expected to graduate (calculated as the number of graduates, regardless of age, divided by the population aged 18 years).
Target 90%

Enrollment rate in preschools (public and private)
An indicator that measures the percentage of children between the age of 3 and 5 and who are enrolled in preschools on the first day of September of the previous year (This indicator emphasizes the importance of providing children with a good foundation at an early age).
Target 95%

Percentage of students with high skills in Arabic, according to national tests - UAE NAP
An indicator that evaluates the Arabic reading skills of ninth grade students in public and private schools applying the Ministry of Education curriculum.
Target 90%

Percentage of schools with high quality teachers
This indicator measures the percentage of schools that meet certain quality standards of teachers based on a clear system of measurement and evaluation.
Target 100%

Percentage of schools with effective school leadership
This indicator measures the percentage of public schools that achieve high scores on effective school leadership based on the school accreditation system.
Target 100%

Enrollment rate in foundation year
This indicator measures the share of students who have to undergo foundation year (a program usually focusing on strengthening Arabic, English, Math and IT) out of the total university applicants in the same year
Target 0%



INTERVIEW

INTERVIEW:

HE ENG. SUHAIL MOHAMED FARAJ AL MAZROUEI

Minister of Energy, UAE

UNITED ARAB EMIRATES
MINISTRY OF ENERGY



Since 2013, the Ministry of Energy has been undergoing restructuring. Please can you explain why this was necessary?

HE Eng. Suhail Mohamed Faraj Al Mazrouei: In 2013, the UAE Cabinet changed the mandate of the ministry, tasking it with regulatory functions to ensure coordination of the energy sector on a federal level. With the change in mandate, we worked on changing the organisation. Our priorities are the security of energy supply and ensuring the sustainability of that supply in the future. We also aim to build a strong foundation of regulations governing the sector, and to help reduce greenhouse gas emissions and protect the environment, while ensuring the economy continues to grow. All of the above points are key pillars of the UAE Energy Policy that we are now working to put in place.

> "Our priorities are the security of energy supply and ensuring the sustainability of that supply in the future"

Can you share more about the process of devising the policy?

HE Eng. Suhail Mohamed Faraj Al Mazrouei: We are now in the scoping phase and working closely with a large number of stakeholders. We cannot do it alone – we are engaging all of the partners and electricity authorities in the country, as well as suppliers of natural gas and many other players. We are aiming to conclude the draft document in 2015 and present it to the Cabinet. Once approved, the policy will provide the foundation for the laws that will regulate the sector.

The Ministry is already working on a number of important initiatives. We are developing a conservation law. Following the change in standards for cleaner diesel fuel, we are drafting a law to prevent the smuggling of diesel with high levels of sulphur. We have been working on many different initiatives but the foundation was not there. Once the policy is in place, it will act as an enabler for more targeted efforts within each of the priority areas.

Ultimately, what does the policy aim to achieve? Why is this important for the country?

HE Eng. Suhail Mohamed Faraj Al Mazrouei: Energy has become a challenge for many countries – in terms of the security of supply, its impact on the economy and the environmental impact of energy generation. Here in the UAE, we are blessed with abundant oil and gas resources but those resources, especially when it comes to natural gas, are not enough to ensure the continued growth of our economy. Today, we are already importing half of the natural gas needed for electricity generation.

In the future, this is not going to be enough and the country has decided to diversify further. We have entered two new components into the mix. One is renewable energy, and we already have three projects feeding the grid. We are hoping to have more solar projects. We have also invested in nuclear power and from 2017 onwards, we expect contributions from the nuclear plants now being built. By 2020, they will provide around 20 per cent of our energy needs, while natural gas will account for 70 to 75 per cent. The energy mix is decided and the foundation is there, up until 2020. But where are we going beyond then? How will the evolution of the different electricity-generation technologies affect our energy mix in future? That is what the policy is trying to determine.

Also, within the UAE Vision 2021, the ministry has been asked to achieve five national-agenda targets related to clean energy, water availability and productivity, reduction of carbon emissions and energy intensity. Through the policy, we will ensure that we have the laws in place to achieve the 2021 targets.



> Within the UAE Vision 2021, the ministry has been asked to achieve five national-agenda targets related to clean energy, water availability and productivity, reduction of carbon emissions and energy intensity.

What is the UAE doing to ensure the future security of its energy supplies?

HE Eng. Suhail Mohamed Faraj Al Mazrouei: Today, we are targeting three sources of natural gas. One will be the indigenous gas reserves and for that, the Abu Dhabi National Oil Company is developing more challenging resources like sour gas, focusing on exploration and trying to discover more resources. But we know that this alone is not going to be enough.

Through Dolphin Energy we are already receiving significant amounts of natural gas from Qatar. In Dubai, we currently have a facility with the capacity to import three million tonnes of liquefied natural gas (LNG) per year. We are looking to build a facility with an import capacity of nine million tonnes in Fujairah. Together, the two will eventually deliver an amount that is close to what the Dolphin pipeline imports into the country. We have the infrastructure to import more, both in terms of pipeline supplies and LNG, and there is space to grow our local natural-gas production.

The same applies for nuclear energy and solar power. When it comes to solar capacity, we can even go beyond the targets that some emirates have already announced, as long as this makes commercial sense. We need to see solar power becoming reasonably close to natural gas in terms of price.

Electricity tariffs in the UAE – for both individuals and entities – are among the lowest in the world. Will the new policy seek to change this?

HE Eng. Suhail Mohamed Faraj Al Mazrouei: The policy will certainly tackle some issues such as the subsidies that we currently have. We need to achieve sustainable growth for our economy and we cannot do that, in my view, without a robust energy policy that examines some of the challenges associated with high levels of subsidies. One of those challenges is inefficiency, which is a problem when you examine the consumption pattern of some users.

We are not a regulator of electricity prices. Each emirate decides prices independently, but part of the price reflects the cost of supply of natural gas for that entity. The gas prices negotiated in earlier contracts are cheaper than the prices of gas today. In the future, we will import more LNG, which is five times the average price we currently have here. That is going to have an impact. Either we will need to have significantly more subsidies within the system, because of these new higher prices, or we need to look at reducing the subsidies and working to improve energy efficiency. So, we are not simply saying the prices need to be higher; we are also helping customers consume less electricity. ■

THE UAE'S ENERGY MIX

ARTICLE

By Eng. Ahmed Al Awadi and Hannes Reinisch



> The UAE's demand for energy grows to the tune of 9% annually

KEY DRIVERS, TARGETS AND A PROGRESSIVE VISION

Energy fuels the growth and diversification of the UAE economy. Oil and gas have underpinned the country's economic development for more than 50 years – fossil fuels enable transport, desalinate water and generate electricity for everything from cooling our buildings to powering our mobile phones.

As the UAE economy grows, so does the demand for energy – to the tune of 9% annually according to the latest estimates by the Ministry of Energy. While oil and gas have historically been the dominant fuels powering the UAE economy, the UAE's energy sector is undergoing a transformation targeting the diversification of the UAE's energy mix. Most significantly, according to the National Agenda 2021, the share of power generation from gas will drop from 98% in 2012 to less than 76% in 2021 as clean energy – mainly renewable energy and nuclear – enter the mix, and energy-efficiency efforts intensify.

There are three key factors driving this transformation. Firstly, the UAE aims to extend its global energy leadership across the industry spectrum through pioneering new technologies and creating a knowledge-based economy, positioning it to capitalise on new opportunities and market developments. Secondly, the UAE is committed to green and sustainable growth, with a focus on growing the UAE economy while reducing the impact on the environment and its carbon footprint. Thirdly and most importantly, is ensuring the energy security of the UAE, given that natural gas is not expected to enjoy a relatively low price in the long run. The UAE has access to some of the world's lowest-cost gas to date, both from domestic production and pipeline imports. However, incremental domestic production and imports of expensive liquefied natural gas (LNG) are priced at a level where the alternative energy sources – whose costs are falling – are becoming both competitive and financially attractive.

Transforming the Power Sector

The power sector is the main focus of diversification. At present, there are over 27 gigawatts (GW) of installed capacity across the seven emirates that are utilising the cleanest fossil fuel available: natural gas. In terms of existing fuel supply, records show that domestic production of natural gas meets about 50% of electricity demand, with the rest currently being imported. Oil is only used as an emergency back-up fuel, and the UAE currently does not use coal as fuel. The fleet of UAE power plants is relatively efficient and modern, the majority having been constructed within the past 10 years. Natural gas and efficient power plants together mean the UAE currently has one of the lowest carbon intensities (CO_2 emitted per kilowatt-hour) in electricity generation in the region, also below the global average.

The UAE government has set a target of a 24% clean energy contribution under the UAE National Agenda Vision 2021. This builds on the existing renewable energy targets of Abu Dhabi (7% by 2020) and Dubai (5% by 2030).

The 24% by 2021 will be achieved through the implementation of both nuclear and clean-energy projects – multiple new power plants have already been completed, are under construction, or are in various stages of development. With renewable-energy technology costs continuing to fall, more projects are expected to be implemented by 2030.

The 5.6GW of nuclear power in Barakah will substantially diversify the UAE energy mix. The first reactor will come online in 2017, with three more units launching between 2018-2021 with a total capacity of 5.6GW.

In renewables, solar is currently viewed as the most attractive renewable technology for the UAE, as the country is blessed with abundant sunshine, and the technology is mature, with project implementation and further technology developments bringing down costs so substantially that solar power can compete with fossil fuels. Solar photovoltaic (PV) is already cheaper in the UAE than diesel-fired power generation and cheaper than gas-fired electricity where expensive LNG imports are used to meet the growing demand. The list of solar projects spans the country, with roughly 140MW in operation in 2014. The 10MW Solar PV plant in Masdar City was the country's first large-scale solar-power plant and has provided valuable data from over 5 years of operation, since 2009. It has proven, for example, that keeping solar panels clean – which was an expected challenge in a dusty, sandy environment – is actually a simple operation and a maintenance task with almost negligible costs and minimal water requirements. Commissioned in 2013, the Shams 1 concentrated solar power (CSP 100MW) plant in the western region of Abu Dhabi is one of the largest CSP plants in the world. It uses a thermal solar technology that has the potential for cost-effective energy storage so that electricity can be generated even when the sun has set. The 13MW solar PV plant in Dubai's Sheikh Mohammed Bin Rashid Solar Park is the most recent installation, also commissioned in 2013.

The next solar plant to enter the UAE's power-generation mix is likely to be the 100MW PV plant that is currently in the tendering phase, also situated in the Sheikh Mohammed Bin Rashid Solar Park, which is planned to accommodate up to 1000MW of solar installations. Waste-to-energy projects have also been announced in Sharjah and Abu Dhabi, which will provide a three-for-one benefit (renewable energy, sustainable waste disposal and decarbonisation). Other renewable energy sources are also being explored, including wind farms under study in Abu Dhabi and Fujairah and a wind and solar-powered micro-grid on Al Futtaisi Island in Abu Dhabi. Notably, in 2014, Masdar also launched a solar desalination pilot programme that is believed to be one of the most important programmes in the UAE, addressing both energy and water-related challenges, which can support driving the technology deployment for the benefit of UAE and the region.

Another way to ensure sustainable growth of the energy sector in the UAE, which has been moving forward in steady steps, is utilising the existing resources more efficiently through launching programmes and initiatives promoting energy-efficiency improvements. These improvements are on the generation side as well as the demand side and can optomise resource utilisation through improved supply and demand planning, from the conversion of existing open-cycle plants to more efficient combined-cycle plants, which is a proven way to produce additional power with no additional fuel requirements and reduce carbon emissions. The UAE has also demonstrated leadership in the region through pioneering the deployment of carbon-capture technology aimed at enhancing oil recovery which is currently being implemented in Abu Dhabi by ADNOC and Masdar.

Integrated Planning and growth

To ensure a coordinated and integrated approach towards the diversification of the UAE's energy mix, the Ministry of Energy is leading the development of a federal energy strategy with the participation of the UAE local and federal energy-sector players, which aims to build on existing energy strategies and develop a consolidated federal strategy that can ensure the sustainable growth of the energy sector through the participation of all the Emirates.

> "The share of power generation from gas will drop from 98 per cent in 2012 to less than 76 per cent in 2021."

From Vision to Action

The past 5 years has brought about considerable progressive change in the visions and strategies for energy in the UAE. These changes aim to ensure energy security through diversifying the energy mix and improving energy efficiency and integration. The initial projects completed were a pioneering first wave towards those goals. With the nuclear programme now well underway, solar costs having reached an all time low and other clean energy technologies are offering significant benefits to the UAE – the positive transformation of the UAE energy sector has started.



Transport and Industry

Energy used for power and water are, of course, just a portion of the total energy requirements – transport being another key energy consumer (See Chapter 6 on Transport and Mobility), as well as energy use in industries beyond electricity (See Chapter 3 on Fuels, Infrastructure and Industry). As with power and water, substantial opportunities exist to diversify fuel sources and improve efficiency – from fuel-efficient hybrid vehicles and electric vehicles to biofuels for aviation, to renewable energy applications for industrial processes. ■

Energy Efficiency

Cutting across all sectors, energy efficiency is a key priority for the government – and effectively a new source of supply, which is often the cheapest. Dubai has set a target to reduce energy consumption by 30% by 2030.

The UAE is already employing several tools to cut demand. Building codes became mandatory in 2011 in Abu Dhabi under the Estidama programme and in Dubai under the Green Building Code in 2014. Estidama is already delivering 30% reductions in buildings' energy and water consumption at no additional cost. The Emirates Standardization & Metrology Authority (ESMA) has also set mandatory performance standards for AC units and lighting and is expanding its coverage of appliances. Cost-reflective pricing in the power sector has also been instituted in Dubai which is complemented by a pioneering legal framework to allow energy service companies to monetise savings from efficiency improvements. The government has additionally focused on consumer (and future consumer) education, with customer and school programmes initiated by the Emirates Wildlife Society-World Wildlife Fund, Environment Agency Abu Dhabi, and the Regulation and Supervision Bureau, among others.

Looking forward, energy efficiency will gain greater prominence, specifically targeted by both the UAE's green growth strategy and the federal energy strategy. It is expected to have the greatest impact on the country's energy profile.

FOOTNOTES

[1] The International Energy Agency (IEA, Co2 Highlights 2012) estimated global average for generation emissions intensity at 565g/KWh in 2010 (CO_2 emitted per kilowatt-hour) – current UAE estimates range from 430 to 500g/KWh. This is lower than other regional or global emerging economies using less efficient generation technology (more open cycle gas turbines) or dirtier fuels (oil, coal etc). Expectations for the UAE 2021 generation mix range from 260-330g/KWh.

ABOUT ENG. AHMED AL AWADI



He is the Director of Clean Energy and Climate Change in the UAE Ministry of Energy.

ABOUT HANNES REINISCH



He is an Energy & Sustainability Advisor in the Ministry of Foreign Affairs, UAE.



INTERVIEW

INTERVIEW:

HH SHEIKH AHMED BIN SAEED AL MAKTOUM

Dubai Supreme Council of Energy

المجلس الأعلى للطاقة
Supreme Council of Energy

What are the main pillars of the Dubai Integrated Energy Strategy (DIES) 2030?

HH Sheikh Ahmed Bin Saeed Al Maktoum: The Dubai Integrated Energy Strategy 2030 has been structured to streamline the following objectives aimed at achieving a green economy and sustainable development of the Emirate:

- Security of energy supply to sustain Dubai's growth
- Diversification of fuel sources
- Energy efficiency and demand-reduction
- Set the regulatory framework required to drive implementation of the strategy and boost private and public investment in clean energy projects

The UAE's federal approach in developing a green economy requires integrated and judiciously designed policies to promote and support an increase in investment in renewables. How does DIES 2030 align with the UAE Vision 2021?

HH Sheikh Ahmed Bin Saeed Al Maktoum: Dubai has structured a balanced approach to achieve the national vision of a green economy through the deployment of the Dubai Integrated Energy Strategy 2030. Over the last few years, we have delivered specific initiatives and projects to support clean energy and sustainability within the UAE. A roadmap has been defined, reflecting clean energy supply and demand abatement measures. We have delivered projects in solar power, power and water rationalisation, green building standards and energy performance contracting, and put in place a regulatory framework to steer different phases of execution.

> "The National Agenda sets a target of 24% as the share of clean energy in the total fuel mix for the UAE."

What kind of measurable targets can be set to achieve Vision 2021?

HH Sheikh Ahmed Bin Saeed Al Maktoum: The National Agenda sets a target of 24% as the share of clean energy in the total fuel mix for the UAE. Dubai is targeting a 5% solar share to diversify fuel sources and this percentage has the potential to increase as solar technology becomes economically competitive. We have also developed plans to reduce demand by 30% through programmes and projects promoting green buildings, building retrofitting, district cooling and other energy-efficiency policies.

What role does Dubai play in supporting Vision 2021 for the country?

HH Sheikh Ahmed Bin Saeed Al Maktoum: In line with the visionary leadership of our nation, Dubai has collaborated with various local and federal government bodies to develop a national green growth strategy and in my view, the ongoing execution of significant federal and local programmes will place the UAE on the top of the global index for sustainability and quality of life.

Dubai commenced structured programmes and projects in 2011, focusing on energy conservation, clean energy, developing a regulatory framework and building national capacity, and will continue to play a dynamic role in supporting the national vision.

> "Dubai is targeting a 5% solar share to diversify fuel sources and this percentage has the potential to increase as solar technology becomes economically competitive."

A spike in domestic and foreign investment in infrastructure, research and development, and over-subscription by private sector entities can carry certain risks (i.e. barriers to entry for local players, high upfront capital costs, etc.) How can these risks be mitigated going forward? How can the benefits and returns be heightened?

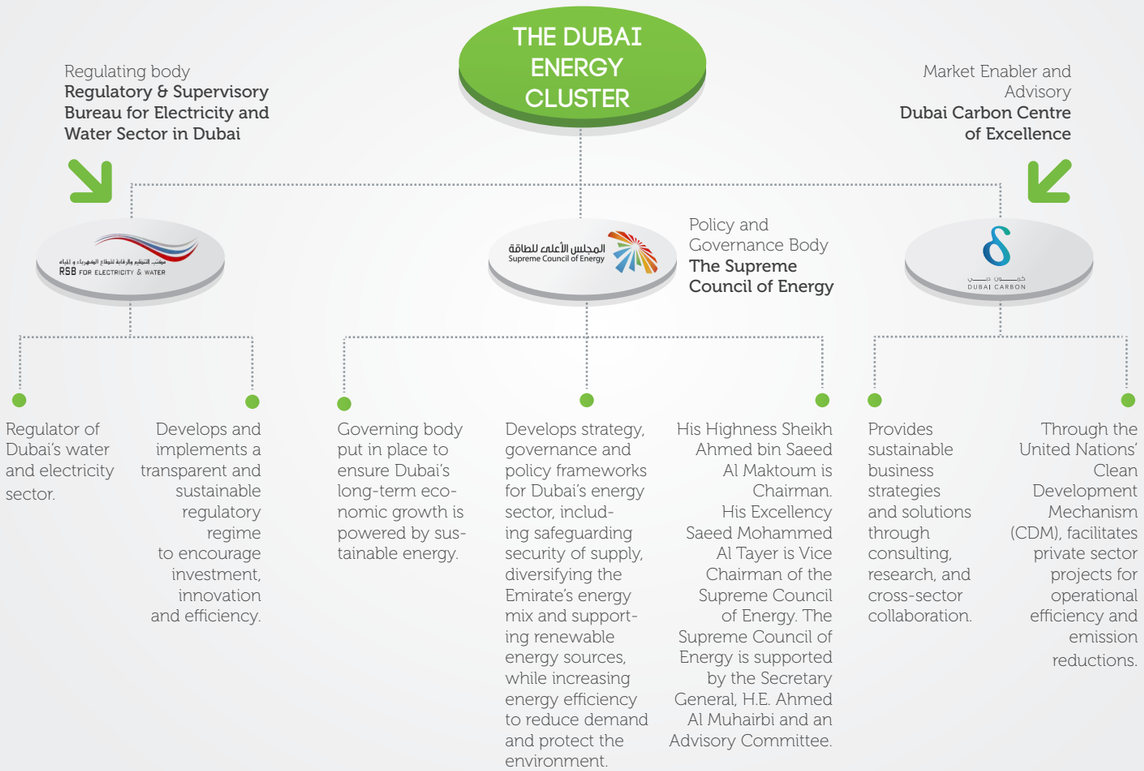
HH Sheikh Ahmed Bin Saeed Al Maktoum: We have planned some of our new projects to be funded through Public Private Partnership (PPP) and have developed a regulatory framework to attract international investment into Dubai. As an example, our 100 MW solar and clean coal projects are based on the PPP model. We have seen great interest from technology and financing firms to partner with us on the execution of planned projects and shall continue to facilitate this method of engagement. When the market is supported by clear and feasible regulatory frameworks, the risks can be mitigated.

Due to the higher labour intensity of various renewable-energy technologies compared with conventional power generation, increased investment in renewable energy ideally should add to both short-term and long-term employment. How can the UAE accommodate the demand for skilled human resources?

HH Sheikh Ahmed Bin Saeed Al Maktoum: We have integrated capacity building into our strategy by developing our nationals in the clean energy field. We have initiated programmes targeting students at secondary school and university levels where the issues of sustainability, energy efficiency and solar power have been defined within the academic curricula.

One of the recently launched programmes is 'Carbon Ambassadors', where students are selected and mentored to become facilitators in their communities, promoting a low-carbon economy. Their innovative ideas and contributions will be recognised through reward schemes to promote awareness and education in the field of sustainability and clean energy.

> We have delivered projects in solar power, power and water rationalisation, green building standards and energy performance contracting (...)



WHAT IS THE CARBON INTENSITY OF THE UAE ECONOMY?

ARTICLE

By Meshayel Omran Lehsooni and Eng. Sommayah Alyammahi



The United Arab Emirates is committed to the environment – this has been proven through numerous initiatives, both local and international, in regards to reducing carbon emissions and the environmental footprint. The UAE is a regional landmark; a beacon that leads by example in environmental matters.

H.H. Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, set the UAE National Agenda as an extension to achieve the UAE Vision 2021, which coincides with the 50th anniversary of the Federation. The government of the UAE set an inspirational goal for the Ministry of Energy to lead the efforts to reduce CO2 emissions by 15% by 2021 to address one of the goals of the UAE Vision 2021.

The indicator serves to highlight progress at international and national levels and can be used in measuring environmental performance and green-economy development. Indicators can further be used at the national level in planning and following the progress of sustainable development in order to achieve the government vision, committed to protecting the environment.

Energy-related activities account for the dominant portion of GHG emissions in the UAE. The country relies heavily on combustion of fossil fuels as the source of energy for water desalination, power generation, manufacturing and energy industries. Electricity generation from fossil fuels is responsible for almost half of the country's emissions. Industrial processes are the second-largest emitter of anthropogenic GHG emissions in the UAE, while steel-making and aluminum industries are considered the dominant source of CO2 emissions. Yet, it is worth mentioning that the UAE has already taken action and applied best practices to reduce GHG emissions and simultaneously enhance the country's economic development.

Indeed, the national emissions of the UAE are quite low relative to global-emission levels. However, the UAE is committed to being part of the broader international community and trying to achieve a reduction in emissions with available capabilities, as the leadership believes that the battle against climate change cannot be won without collaboration and multilateral initiatives.

The Intergovernmental Panel on Climate Change (IPCC) highlighted anthropogenic greenhouse gases such as carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), which reached their highest recorded levels in the 1990s. Most of the emissions were attributed to combustion of fossil fuels, agriculture, and land-use changes. Since the beginning of the industrial revolution in the 1750s, the atmospheric concentration of CO2 has increased from 280ppm to 389ppm in 2010, and this level is predicted to increase dramatically over the next few decades.

The UAE is a non-Annex I Party, as categorised by the United Nations Framework Convention on Climate Change (UNFCCC), with no legal obligations to reduce emissions. The country submitted three national communication reports to the UNFCCC secretariat in Bonn, Germany, in 2007, 2010 and 2013 respectively.

In terms of its UNFCCC obligations, the UAE has laid out a number of actions to slash its carbon emissions, such as by monitoring and tracking GHG emissions to assist in identifying their impact and assessing policies, strategies and measures for reducing GHG emissions. The actions contribute to the UAE's drive to attain green growth and sustainable development, as indicated in its stated commitment to expand the role of low-carbon technologies in the economy and invest in renewable energy and nuclear energy options. This is expected to significantly reduce CO2 emissions and the environmental footprint. This is done through a well-devised strategic plan and effective initiatives to turn the UAE Vision 2021 into reality. ■

ABOUT ENG. MESHAYEL OMRAN LEHSOONI



She is the head of climate change in the Ministry of Energy. Ms. Meshayel is responsible for the section of climate change activities, including the preparation of the fourth national communication report of the UAE, the GreenhouseGas Inventory of the UAE as well as the State of Energy Report 2015.

ABOUT ENG. SOMMAYAH ALYAMMAHI



She is a Green Building Architect in the UAE Ministry of Energy.



A GLOBAL AND MULTIFACETED – TEAM PLAYER

ARTICLE

By Dane McQueen

THE UAE IN INTERNATIONAL ENERGY ORGANIZATIONS

The UAE has emerged as one of the most fascinating countries at the global political level when it comes to energy, straddling institutional focus areas that were once seen as nearly mutually exclusive. This engagement across the energy spectrum reflects the UAE's diversification strategy, as well as the international community's interest in a hydrocarbon power that has come out strongly in support of low-carbon energy technologies.

The UAE historically is perhaps best known as member of the Organization of the Petroleum Exporting Countries (OPEC), where it makes one of the largest and most reliable production contributions. Abu Dhabi joined the Vienna-based organization in 1967, switching over to UAE membership in 1971 following federal unification. Through OPEC, the UAE also works with the Riyadh-based International Energy Forum (IEF), a joint effort of OPEC and the Paris-based International Energy Agency (IEA) to manage hydrocarbon supply and demand stability issues. IEF countries account for more than 90 per cent of global oil and gas supply and demand and maintain the Joint Organisations Data Initiative (JODI), the international oil and gas data transparency programme.

> "In 2011, the UAE was unanimously named the permanent host of the International Renewable Energy Agency (IRENA), making the latter the first major multilateral organization in the Middle East (...)



The UAE is also an early (1970 through Abu Dhabi) member of the Organization of Arab Petroleum Exporting Countries, which is headquartered in Kuwait and facilitates joint projects and cooperation within the regional oil industry. Given its role in the global gas market, the UAE additionally participates in the Gas Exporting Countries Forum, headquartered in Doha, and the International Gas Union, headquartered in Oslo.

But it is the UAE's leadership in low-carbon energy organizations that has markedly reshaped its global profile.

> "[The UAE] serves on the board of the United Nations' Sustainable Energy for All (...) and REN21, the Paris-based renewable energy policy network"

Most notably, in 2011, the UAE was unanimously named the permanent host of the International Renewable Energy Agency (IRENA), making the latter the first major multilateral organization in the Middle East and globally the first dedicated to the deployment of renewable energy. The organization is mandated by over 165 countries to serve as the platform for cooperation and data analysis on renewable energy technology development, financing, policy, and capacity-building. The selection of Abu Dhabi, as well as the UAE's substantial technical and financial contribution to the Agency, made waves. It not only challenged the view of the Middle East as a hydrocarbon-only region, but also highlighted the huge potential of renewable energy in developing countries. In 2011, only the UAE had a renewable energy programme in the Gulf Cooperation Council (GCC). Two years later, the six GCC countries announced over 60 GW of renewable energy projects.

> "In 2011, only the UAE had a renewable energy programme in the Gulf Cooperation Council (GCC); two years later, the six GCC countries announced over 60 GW of renewable energy projects"

The UAE has continued to expand its clean energy cooperation. It serves on the board of the United Nations' Sustainable Energy for All, the largest global partnership for energy access, renewable energy and energy efficiency, as well as on the board of REN21, the Paris-based renewable energy policy network. It is also the only Arab member of the Clean Energy Ministerial, a group of the world's 23 largest and most innovative economies focused on voluntary carbon mitigation through clean energy deployment. There, the UAE supports multilateral initiatives on sustainable urbanization, renewable energy resource assessment, women in science and technology, and carbon capture and storage. The UAE is also a founding member – and host of the Middle East headquarters – of the Global Green Growth Institute, launched in Seoul in 2012. It aims to decouple environmental impacts and economic growth through policy, with a pronounced focus on energy, and contributes to the UAE's own green growth strategy.

The UAE has furthermore become a leading voice on peaceful nuclear power, which will cut nearly a quarter of carbon emissions from the domestic electricity sector in 2020. Through its mission to the International Atomic Energy Agency (IAEA) in Vienna, the UAE has pursued a 'gold-plated' approach to nuclear development, based on full transparency and international cooperation. The UAE has been widely recognized for its efforts to create a new, replicable model for nuclear governance and safety.

Cutting across these different energy sectors, the UAE also works on joint projects and research under the League of Arab States, the GCC and the London-based World Energy Council (WEC). The Arab League and IRENA have recently partnered on a renewable energy strategy for the Middle East and North Africa, and the GCC is developing a standard minimum green building code. The UAE is a longstanding and active member in WEC, especially with its strong hydrocarbon legacy and enhanced focus on sustainability issues.

Through its energy engagement in all international organizations, the UAE aims to develop its message and strategy of diversification. The country's expanding role both normalizes an integrated view of the industry (the host of IRENA and an OPEC member) and ensures that the UAE has access to the right information and partners. Ultimately, it should make for smarter policy and investment choices, and a broader market for the UAE's solutions. ■

ABOUT DANE MCQUEEN

He is an Energy Expert



INTERVIEW

INTERVIEW: HE AHMED AL MUHAIRBI

Secretary General of Dubai Supreme Council of Energy (DSCE)

How does Dubai's collaborative spirit drive the energy sector?

> Through this collaboration, we gathered market information on how to implement projects in Dubai without creating a burden on the community (...)

As a cornerstone for sustainable development, energy efficiency is an area where there is a need for collaboration and knowledge sharing. How crucial are PPPs in the UAE's drive for demand and supply-side management?

HE Ahmed Al Muhairbi: We consider energy efficiency, demand reduction, energy security and the cost of energy as crucial elements of our strategy. The cost of energy is key, as is bringing in financial mechanisms to encourage investment from international companies and technology providers.

To this end, we employed the Public Private Partnership model as a mechanism to fund projects and further develop our capabilities across various technologies including solar, energy efficiency, district cooling and green building construction, amongst others.

To achieve our goals, it is essential to develop the know-how here in the UAE, building capacity within areas such as renewables, which has become a focal issue. It is also essential to determine the best technology for our climate and environmental conditions. Besides maintaining the Solar Project – Sheikh Mohammed bin Rashid Solar Park – which is intended to link independent renewable-power generators to the grid in Dubai, we aim to become a global development and manufacturing hub and to promote the economic advantages of solar and other technologies. This is an ambitious goal, but one we firmly believe is achievable.

How can DSCE apply the lessons learned in the past five years to build a case for the PPP model?

HE Ahmed Al Muhairbi: The local energy sector is a key player in DIES 2030 for the security of supply and integration of clean technology. This is reflected in the DSCE structure, where each entity has a defined role in project execution, including the solar project. Funding for the 13 MW PV Solar Plant has been allocated across the DSCE entities. This paves the way for the next phase of the solar project through the PPP model. We have developed a regulatory framework to attract international investment and to date we have seen great interest in public private partnerships.

> In the DSCE structure (...) each entity has a defined role in project execution

DSCE, as a regulator, helps strengthen the capacity of the public sector to enter into Public Private Partnership (PPP) transactions. Can you describe how this is carried out?

HE Ahmed Al Muhairbi: In my view, an effective policy framework enables governments to influence market dynamics. This is evident from the initial planning phases of a number of our programmes and projects. A regulated industry, with the support of government, can facilitate successful project execution. Over the last three years, we have hosted open sessions to share our planned policies and programmes with stakeholders. This has included organisations involved in district cooling, solar power, waste-to-energy, alternative transportation fuel, building efficiencies and real estate development, as well as other relevant entities.

These interactive sessions were intended to educate stakeholders on upcoming regulations and programmes driven by DIES 2030 with an additional objective of sharing views on the inherent challenges and opportunities. Through this collaboration, we gathered market information on how to implement projects in Dubai without creating a burden on the community, while facilitating a forum for exchange in order to design the implementation phase. It has been a rewarding experience and we have fostered understanding among key players on Dubai's vision for advances in sustainability of energy supply and demand reduction.



Can you identify some exemplar PPPs in Dubai/UAE (energy efficiency and/or renewable energy)?

HE Ahmed Al Muhairbi: We have developed the following projects in partnership with private sector entities:

- 100MW Solar PV project, set for commissioning in 2017.
- 600 MW Clean Coal Power Plant (commissioning in 2020) with another 600 MW in the subsequent phase.
- Energy performance contracting (ESCO companies) for retrofitting more than 30,000 buildings across Dubai.

What kind of expertise does the public sector need to enter into successful PPP partnerships? What can the private sector do in order to secure bids through best practices?

HE Ahmed Al Muhairbi: The DSCE, as a governing body, is engaged with local, regional and international entities representing government, industry, financing and NGOs. These engagements provide a good benchmarking tool to assess where we are now and how best to facilitate the next phase. We thoroughly evaluate best practices in the region and globally before initiating our own plans for implementation in Dubai. This fits with our approach in promoting the principle of Public Private Partnership. The model builds the capabilities of both public and private partners, as experience is gained through the execution of specialised projects over the years. These are joint efforts to deliver mutual benefits and build capacity for ongoing projects. ■

> Over the last three years, we have hosted open sessions to share our planned policies and programmes with stakeholders.

The Dubai Supreme Council of Energy (DSCE) was formed in August 2009 under Law 19 of 2009, issued by His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE, and Ruler of Dubai. His Highness Sheikh Ahmed bin Saeed Al Maktoum was appointed as Chairman for the Council and His Excellency Saeed Mohammed Al Tayer as Vice Chairman. The Council has a Secretary General and an Advisory Committee composed of competent specialists. The new governing body seeks to ensure that the emirate's growing economy will have sustainable energy options, while preserving the environment. The authority is developing alternative and renewable energy sources for the emirate, while increasing energy efficiency to reduce demand.
→ http://www.dubaisce.gov.ae

FACT BOX

THE MINISTRY OF ENERGY AND VISION 2021

The growth of the UAE's global competitiveness is a mandate of the Emirates Competitive Council, a UAE federal government organization that conducts policy research and analysis in support of UAE Vision 2021. The national key performance indicators fall under six categories:

- Cohesive society and preserved identity
- Safe public and fair judiciary
- Competitive knowledge economy
- First-rate education system
- World-class healthcare
- Sustainable environment and infrastructure

Sustainable environment indicators include air quality index, percentage of treated waste of total water generated, share of clean energy contribution and water scarcity index. Each of these evaluation methods is the responsibility of an assigned government ministry while the Emirates Competitive Council is a knowledge provider that facilitates the achievement of positive results. The UAE Ministry of Energy is sponsoring the 'Share of Clean Energy Contribution' and the 'Water Scarcity Index'. More information can be found on http://www.vision2021.ae/en/national-priority-areas/national-key-performance-indicators

CALENDAR OF EVENTS

	Name of Event	Location	Start Date
NATIONAL	Abu Dhabi International Petroleum Exhibition and Conference	UAE - Abu Dhabi	11-Nov-14
	Sustainable Energy & Environmental Protection Conference	UAE - Dubai	23-Nov-14
	Smart, Sustainable and Healthy Cities	UAE - Abu Dhabi	14-Dec-14
	The 6th Gulf Intelligence UAE Energy Forum	UAE - Abu Dhabi	13-Jan-15
	Abu Dhabi Sustainability Week	UAE - Abu Dhabi	19-Jan-15
	a) Blue Economy Summit	UAE - Abu Dhabi	19-Jan-15
	b) 2nd Ecowaste Exhibition	UAE - Abu Dhabi	19-Jan-15
	c) International Renewable Energy Agency (IRENA) Fourth Assembly	UAE - Abu Dhabi	19-Jan-15
	d) 8th World Future Energy Summit (WFES)	UAE - Abu Dhabi	19-Jan-15
	c) Zayed Future Energy Prize Awards and Gala Dinner	UAE - Abu Dhabi	19-Jan-15
	d) 3rd International Water Summit (IWS)	UAE - Abu Dhabi	19-Jan-15
	Dubai International Humanitarian AID Conference	UAE - Dubai	24-Mar-15
	Arab Oil and Gas Show	UAE - Dubai	21-Apr-15
	WETEX	UAE - Dubai	21-Apr-15
	World Green Economy Summit	UAE - Dubai	22-Apr-15
	21st GCC Smart Government and Smart Services Conference	UAE - Dubai	16-May-15
	Dubai International Project Management	UAE - Dubai	TBC
INTERNATIONAL	First Ministerial and Policy Conference on Sustainable Transport	Nairobi, Kenya	28-Oct-14
	Conference of the Parties (COP 11)	Quito, Ecuador	3-Nov-14
	UNIDO Forum on Sustainable Industrial Development	Vienna, Austria	4-Nov-14
	World Conference on Education for Sustainable Development	Nagoya, Japan	10-Nov-14
	Green Growth and Sustainable Development Forum 2014	Paris, France	13-Nov-14
	UNFCCC COP 20	Lima, Peru	12-Dec-14
	World Energy Council Africa Meeting	Indaba, Africa	16-Feb-15
	EcoBuild Southeast Asia	UK	3-Mar-15
	The 6th Gulf Intelligence Women in Energy	Doha, Qatar	10-Mar-15
	Energy Efficiency Global Forum	Washington DC, USA	12-May-15
	6th World Forum on Energy Regulation	Istanbul, Turkey	25-May-15
	6th OPEC International Seminar	Vienna, Austria	4-Jun-15
	61st UITP World Congress and Exhibition	Milan, Italy	8-Jun-15
	South Africa International Renewable Energy Conference	South Africa	4-Oct-15
	WEC - Executive Assembly Plenary	Columbia	21-Oct-15
	WEC - Future Energy Leaders' Summit	Columbia	21-Oct-15
	UNFCCC COP 21/ CMP 11	Paris	30-Nov-15

KEY DATES

Arab Water Week	World Water Day	Earth Hour	Earth Day	World Environment Day	World Energy Day
11/Jan/2015	22/Mar/15	28/Mar/15	22/Apr/15	5/Jun/15	22/Oct/15



SUPPORTING INTERNATIONAL NEGOTIATIONS

THE UAE'S COMMITMENT TO THE UNFCCC PROCESS

ARTICLE

By Tina Latif



> "The UAE also works within (...) the Cartagena Group, G-77 and China, OPEC, League of Arab States, the Clean Energy Ministerial and the International Civil Aviation Organisation (ICAO)"

As one of its key international engagements, the UAE works as a progressive, bridge-building country within the United Nations Framework Convention on Climate Change (UNFCCC) in support of a legally-binding global agreement to address climate change.

Background to the UNFCCC

The UNFCCC is the main global forum for international climate change negotiations and provides the framework for action to stabilise 'greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous [human-induced] interference with the climate system'. It came into force on 21 March 1994, and now enjoys near universal membership, with 195 parties. All parties to the UNFCCC meet annually at the Conference of the Parties (COP).

In December 1997, at COP 3 in Kyoto, Japan, parties agreed to the Kyoto Protocol, which essentially operationalised the UNFCCC. The Kyoto Protocol commits industrialised countries and countries in transition to a market economy to achieve emission reduction targets. These countries, known as 'Annex 1 parties', agreed to reduce their overall emissions of six greenhouse gases by an average of 5 per cent below 1990 levels between 2008 to 2012 (known as the 'first commitment period'), with specific targets varying from country to country. Due to a complicated ratification procedure, the Kyoto Protocol came into force on 16 February 2005. It currently has 192 parties. → https://unfccc.int

At COP 17 in Durban in 2011, parties agreed to a number of important outcomes, most notably to:

- establish a 'second commitment period' to the Kyoto Protocol, from 2012 to 2020; and,
- negotiate a new legally binding global climate change agreement by December 2015, at COP 21 in Paris, to come into force from 2020.

The UAE's Engagement within the UNFCCC

As the UAE is not an 'Annex 1 Party', it has no legal obligations under the Kyoto Protocol. Nonetheless, the UAE participates in the negotiations with a clear recognition of the urgent need to tackle climate change.

In the lead up to COP 21 in Paris, the UAE will work constructively toward a deal that limits global average temperature rise to 2°C compared to pre-industrial levels (as agreed at COP 16, in Cancun), in a manner that respects the underlying principles of the UNFCCC. First and foremost, this means respect for the principles of 'equity' and 'common but differentiated responsibilities'. The UAE sees climate change as a global issue, which requires action by all countries. However, consideration needs to be given to the varying development contexts and capabilities of different countries. In order to be relevant, the agreement must apply to all counties; in order to be fair, it must not inhibit the development of developing countries.

In this context, another priority for the UAE in the lead up to COP 21 in Paris is forming an appropriate platform within the UNFCCC process through which we, and other developing countries, can communicate our voluntary actions related to climate change mitigation. The UAE has undertaken numerous voluntary actions domestically to mitigate climate change, many of them profiled in this report. We have also made a difference outside our borders, through direct investment in clean energy projects and the provision of development assistance. We have furthermore prioritised at the highest level the diversification of our economy, and our transition from a resource-based to a knowledge-based economy. In the lead up to 2015, we will be looking for ways to communicate these activities in support of the UNFCCC process.

> "We have (...) prioritised (...) the diversification of our economy, and our transition from a resource-based to a knowledge-based economy."

> "The UAE participates in the negotiations with a clear recognition of the urgent need to tackle climate change."

Outside of the UNFCCC

In addition to the formal international negotiations on climate change, the UAE also works within a number of multilateral processes and groups where climate change issues are discussed. Examples include the Cartagena Group, G-77 and China, OPEC, League of Arab States, the Clean Energy Ministerial, and the International Civil Aviation Organisation (ICAO), through which groups negotiations regarding emissions from the aviation sector take place. With two of the world's leading airlines, the UAE endorses the ICAO target of carbon neutral growth for the industry after 2020, as well as a 50 per cent reduction of global international aviation CO2 emissions by 2050, compared to 2020.

This year, the UAE also played a key role in supporting the United Nations Secretary-General's Climate Summit in September. Most notably, we hosted the Abu Dhabi Ascent in May, which was convened by the Secretary-General, presented cooperative initiatives for member states to endorse, and served as the critical milestone in the lead up to the Climate Summit. ■

ABOUT TINA LATIF



She is an expert on Climate Change.

DRIVING DIVERSITY IN THE UAE



HOW EMIRATES GLOBAL ALUMINIUM IS SUPPORTING THE NATION'S ECONOMIC AND ENERGY DIVERSIFICATION AMBITIONS

COMMENTARY

HE Abdulla Kalban

One of the Emirates' industrial flagships, Emirates Global Aluminium PJSC ("EGA") is among the key drivers of the UAE's efforts to diversify its economy beyond crude oil and natural gas sales, as outlined in the Emirate's Economic Vision 2030 document. The company is also an active contributor to the realisation of UAE Vision 2021 in terms of energy and sustainability – specifically, rational use of energy and water, promoting air quality, encouraging conversion of waste to energy, clean and renewable energy, water security, sustainable transport and rational fuel use.

A new aluminium giant, EGA is jointly owned by Mubadala Development Company of Abu Dhabi and the Investment Corporation of Dubai and was formed through the combination of their respective aluminium industry interests.

Alumina Refining Industry Energy Usage

The International Aluminium Institute Fluoride Emissions Reduction Voluntary Objective (2006-2020)

A minimum 35% reduction in global fluoride emissions intensity by 2020 versus 2006

EGA's core operating subsidiaries are Dubai Aluminium PJSC ("DUBAL") in Jebel Ali, Dubai; and Emirates Aluminium PJSC ("EMAL") in Al Taweelah, Abu Dhabi. The combined production capacity of these two mega smelter operations is 2.4 million tonnes per year – which not only represents more than half of the total primary aluminium production in the GCC region, but also makes EGA one of the world's top five aluminium producers by the end of 2014. EGA, which is head-quartered in the UAE, also owns Guinea Alumina Corporation ("GAC") – a strategic bauxite mining and alumina refinery development project in Guinea in West Africa – and has plans for significant local growth and international expansion.

EGA's status in the global aluminium sector is no small achievement given that, through DUBAL, the company poured its first metal in 1979. Today, EGA is a proudly Emirati company, led by UAE Nationals and using proprietary, in-house developed technology that is built on a winning reputation for technological innovation and business performance excellence. EGA's products are used in diverse industrial sectors including automotive and aerospace manufacturing, consumer electronics, food and beverage packaging and the construction industry. A large and stable customer base has been established over the years, with many customers having purchased metal since the company's inception 35 years ago.

Building on the legacy of DUBAL and EMAL, EGA is one of the largest non-oil contributors to the economy of the UAE. It provides a major contribution to domestic economy (forecast to reach US$3 billion direct and US$5 billion indirect GDP impact by 2020) and gross exports (US$7 billion by 2020). Moreover, the group provides direct employment to 7,200 people in the UAE, with the potential to create another 8,000 direct jobs in the UAE by 2020. A strong supporter of the government's Emiratisation ambitions, EGA has various programmes and initiatives in place to increase the proportion of UAE Nationals in our workforce from the current 19 per cent. Our aim is achieve 30 per cent Emiratisation by 2020, which will further support the diversification of the UAE economy by developing a highly-qualified and skilled Emirati workforce.

As one of the largest industrial developments in the UAE outside the oil and gas industry, our company also provides significant opportunities for downstream industries, including supply (machining, contracting, engineering), shipping and logistics. In particular, EGA supports efforts to create aluminium clusters, creating jobs and business opportunities in the process.

Through outsourcing and local purchases, EGA already provides indirect employment to 19,000 people in the greater UAE aluminium-related sector. It is envisaged that EGA will spawn a further 6,000 indirect jobs in the UAE by 2020, raising the total number of indirect employment opportunities to 25,000.

For EGA, these developments form an important part of a bigger sustainability picture. From a raw materials and environment perspective, aluminium production is an energy-intensive business – which means that the lower its energy costs, the more cost-effective EGA is as a business. Using less energy also contributes to reduced consumption of fossil fuels and a smaller carbon footprint.

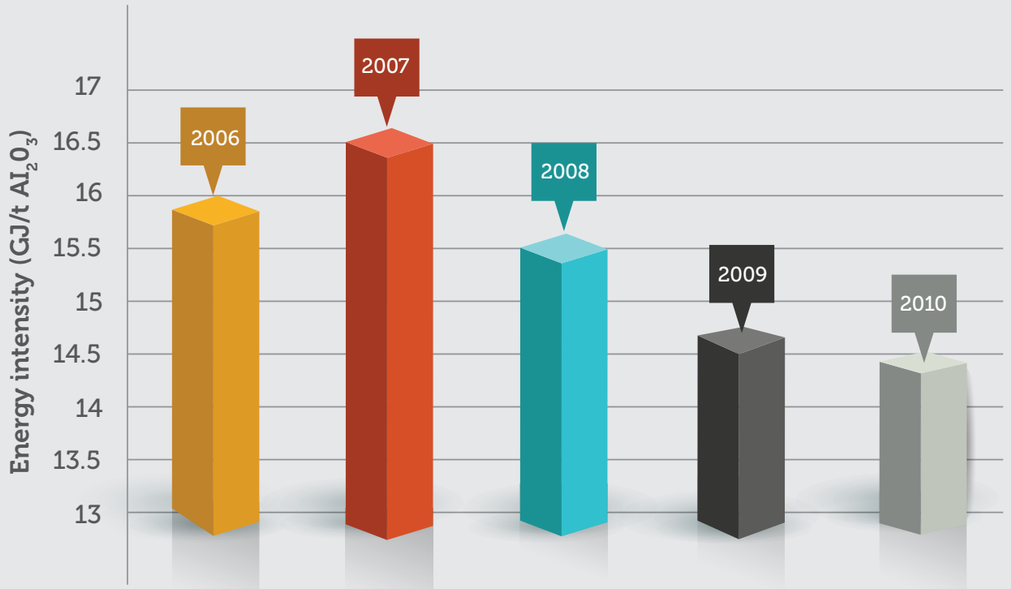


Figure 13 - Refinery energy efficiency, 2006-2010

These factors have underpinned the development over the past 25 to 30 years of advanced, proprietary aluminium reduction technologies that not only increase productivity but also reduce the company's impact on the environment through improved energy-efficiency and reduced emission levels. EGA's DX and DX+ Technologies, developed in-house at DUBAL, have been deployed at EMAL (Phase I and Phase II respectively) and boast benchmark specific energy consumption performances – making the EMAL Operations one of the most energy-efficient in the world. DX and DX+ Technologies also boast extremely low emission levels of perfluorocarbons ("PFCs"), specifically tetrafluoromethane (CF4) and hexafluoroethane (C2F6) which have greenhouse gas warming potential that is 6,500 and 9,200 times greater than carbon dioxide – thereby containing the climate change impact of EGA's smelter operations. The use of these technologies, together with the modernisation of older potlines at the DUBAL Operations through deployment of technological advances, is integral to EGA's drive to ensure long-term competitiveness in an industry that is sensitive to product quality, costs and, increasingly, environmental performance.

A corporate quest for energy optimisation and energy efficiency extends across both of EGA's smelters, spanning all aspects of the operations. For example, efforts to improve the thermal efficiency of the captive DUBAL and EMAL Power Plants enable increased power generation to produce hot metal, while the fuel requirement increment is proportionately less – with direct environmental benefits in terms of fossil fuel combustion and associated environmental emissions, particularly greenhouse gases. As mentioned earlier, EGA dedicates resources to developing advanced reduction technologies to reduce the specific energy consumption of the smelters themselves. The implementation of energy-efficient devices (such as LED lights and motion sensors), the adoption of energy-saving practices (such as turning off non-essential lighting and office automation equipment) and the incorporation of structural adaptations to harness energy-free natural lighting in the corporate and operations areas are among many other examples of EGA's commitment to saving energy, in the interests of the nation and the planet. ■

ABOUT HE ABDULLA KALBAN



He is MD & CEO of Emirates Global Aluminium as well as inter alia Director of the Federal Electricity & Water Authority and serves on the Supreme Council of Energy in the UAE.

ENERGY-WATER-FOOD SECURITY NEXUS IN ABU DHABI

A TRILEMMA OR AN OPPORTUNITY FOR EFFICIENT GROWTH?



COMMENTARY

By Dr. Mohamed Al Madfaei, Maria Cordeiro, and Eva Ramos

The Case for Action

The energy-water-food security nexus is a constant reality in the UAE, present in the vision and strategic direction of top leadership and in the day-to-day affairs of local residents. "Water is more important than oil for the UAE." With these words HH General Sheikh Mohammed bin Zayed Al Nahyan sets a clear direction for domestic policy development and international relations on water, energy and food security.

Ensuring sustainable supplies of water is perhaps the single most important factor in the long term prosperity of the UAE. With 33m^3/capita/yr of freshwater, the UAE is a country with considerable water scarcity. Today the UAE consumes water at unsustainable rates. In 2012, Abu Dhabi alone consumed a total of 2,218Mm^3 of groundwater. Many of the country's usable groundwater resources are close to being exhausted.

New ways of conserving fresh water are urgently needed. This requires strategic thinking as water is not only scarce; in the UAE, water is tightly linked with two other critical sectors: food and energy production. Agriculture is the main consumer of groundwater resources and water desalination is an energy intensive process. The growing demand for water and energy resources in turn can impact ecosystems and their enabling capacity for domestic food production.

Competing demands and the interconnections among energy, food and water production require integrated policy development and investment planning that are mindful of trade-offs between alternative strategies and that consider the economic value of water and energy.

Water Scarcity and Food Security

The great majority of agricultural activities in Abu Dhabi are based on irrigation with scarce groundwater resources. In 2012, agriculture, forests and parks consumed 2,414Mm^3 of water, corresponding to 71 per cent of total water demand in the emirate (SCAD). EAD estimates that agriculture consumes about 50 per cent of the total water used in the emirate, forestry about 11 per cent and public realm amenities around 10 per cent although better metering systems are required to validate these figures.

Groundwater abstractions are significantly above international and regional benchmarks, exceeding 23 times the natural groundwater recharge rate. Aquifers are being depleted and water levels in some areas are dropping between 1.5 to over 5m per year, affecting soil salinity. This can be an irreversible process.

The emirate has been able to overcome limitations of domestic food productivity chiefly through food imports and the acquisition of farmland and food production companies abroad. Abu Dhabi is also fostering domestic food production. To improve domestic agricultural yields and sustainability, the selection of farmland, crops and irrigation and agriculture methods needs to be based on water efficiency requirements.

EAD facilitated the development of a water strategy that protects regions where groundwater levels are falling rapidly. The government agriculture policy framework developed by Abu Dhabi Food Control Authority (ADFCA) paves the way towards a more efficient water use in the emirate. This includes optimizing water use on palm trees, introduction of salt tolerant low water requiring fodder grasses, training of farmers by Abu Dhabi Farmers Services Centre (ADFSC) on how to optimize agriculture inputs and research on crop water requirements, among others.

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Energy Production and Water Desalination

In Abu Dhabi, gas-fired cogeneration power plants produce electricity and use the waste steam for thermal seawater desalination. In the last decade, the desalination capacity in Abu Dhabi increased 3.5 times from 1.17 Mm^3/day (258MIGD) in 2000, to 4.16 Mm^3/day (918MIGD) in 2012, and is expected to double by 2030 to meet the growing demand. In 2012, the great majority of desalinated water was consumed in the domestic sector (549Mm^3), followed by the government sector (281Mm^3), commercial (145Mm^3), industry (180Mm^3), and agriculture, forests and parks (57Mm^3) (SCAD). Water demand forecasts from Abu Dhabi Water Electricity Company show an increase in demand from residential and commercial megaprojects and industry sectors.

Seawater desalination incurs environmental impacts from emissions of air pollutants and greenhouse gases (GHG) and the discharge of high saline brine and cooling water into the marine environment. Desalination discharges affect coastal and marine ecosystems, and can impact fisheries, an important domestic food source and local socio-economic activity. Abu Dhabi's shift from gas-fired cogeneration to peaceful nuclear energy generation will reduce air pollutants and GHG emissions from energy production. Abu Dhabi is also exploring the use of solar power for decentralized desalination technologies.

The Water Strategy for the Emirate of Abu Dhabi

The Water Strategy for the Emirate of Abu Dhabi (2014-2018) brought together decision makers and stakeholders to establish the strategic direction for water management in the emirate of Abu Dhabi. This strategy has implications for water, energy and food security as set forward in the following priorities:

1. **Integrate management of three water sources through well-coordinated governance, better data and enhanced water management plans that consider the economic value of water**.
   Abu Dhabi aims to integrate the production, distribution and demand side management of the three water sources – groundwater, desalinated water and recycled water – and to consider the economic value of water in policy development and investment planning. EAD is conducting a groundwater valuation study to support assessments of new agriculture developments.

2. **Moderate water consumption through optimization of water use in agriculture.**
   EAD is working with ADFCA and ADFSC to improve water use efficiency in agriculture. Abu Dhabi is implementing a multipronged agriculture policy that includes crop choice, integrated arable and livestock farming options, and agriculture and irrigation methods that aims to reduce water consumption by 40 per cent while increasing local production of fruits and vegetables.

   Pricing is an effective mechanism to curb over-consumption and improve water efficiency, as it signals to consumers how much and when to consume. Abu Dhabi is considering a new tariff structure for water and electricity that more realistically reflects the costs of production.

3. **Limit the impact of water desalination on marine and terrestrial ecosystems.**
   Abu Dhabi is studying the impacts of desalination intakes and discharges on the marine environment and strengthening the legal and enforcement frameworks for the power and water production sectors.

The Water Strategy for the emirate of Abu Dhabi proposes innovative approaches to improve demand side management and to conciliate competing demands for water resources. Advancements in water use efficiency and coordination of supply of different water sources are highlighted as essential contributions for improved water management in Abu Dhabi. ■

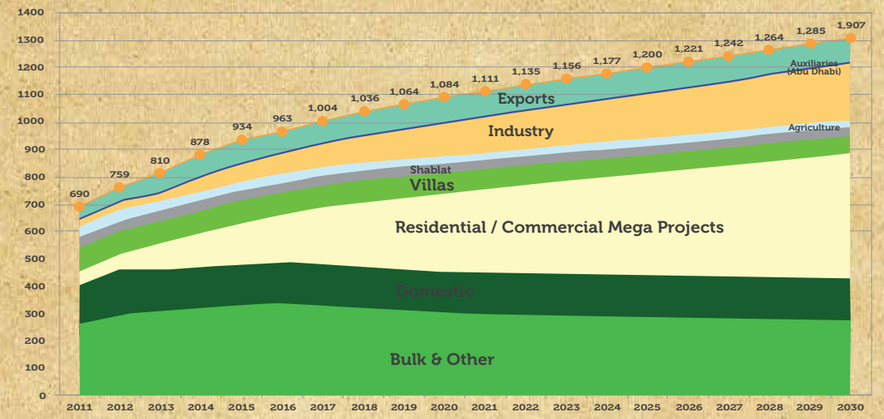
Figure 1 - Water demand by sector in Mm3/year, Abu Dhabi (2012)



	Agricultural, Forests and Parks	Domestic	Commercial	Government	Industry	Other	TOTAL
Recycled	138.80	0.00	0.00	0.00	0.00	0.00	138.80
Desalinated	57.20	548.68	145.12	280.70	18.01	10.59	1,059.23
Groundwater	2,217.90	0.00	0.00	0.00	0.00	0.00	2,217.90
TOTAL	2,413.90	548.68	145.12	280.70	18.01	10.59	3,415.93

Source: SCAD, Abu Dhabi Statistical Yearbook 2013

Figure 2 – Water demand forecast by sector in MIGD, Abu Dhabi (2011-2030)



Source: ADWEC (2013): ADWEC Winter 2012/2013 Electricity and Water Demand Forecasts

THE LIFE IN WATER

"We made from water every living thing" (Qur'an 21:30). Water conservation is embedded in Islam – it is quite common to find in both the Quran and the Sunnah statements and teachings. Islamic principles and ethics, in fact, have always advocated good conduct towards the environment and respect for natural resources.

As a universal religion, born initially in the harsh deserts of Arabia to complete the message of former prophets and convey the divine revelation in its last testament (Qur'an), Islam ascribes the most sacred qualities to water as a life-giving, sustaining, and purifying resource. Water is the origin of all life on Earth, the substance from which God created man (Qur'an 25:54).

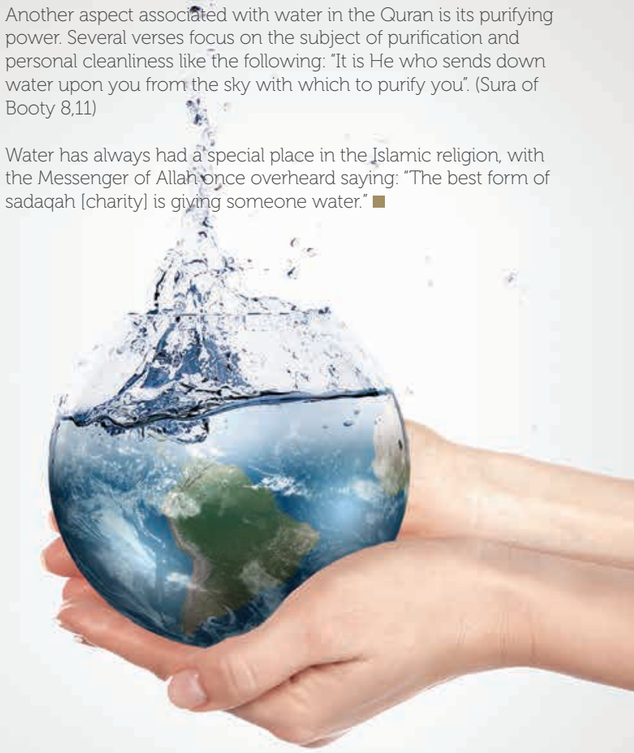
Did you know?
The Arabic word for Islamic Law "Shari`ah" is itself closely related to water. It means "the place from which one descends to water." Before the advent of Islam in Arabia, the Shari`ah was, in fact, a series of rules about water use: the shir`at al-maa were the permits that gave rights to drinking water. The term was later technically developed to include the body of laws and rules given by God.

"Cleanliness is half of faith," The Prophet (peace and blessings be upon him) tells his companions in one of the Hadiths. These well-known and oft-repeated words reveal not only the central importance of purity and cleanliness, but also the essential role water plays in the Islamic religion.

http://english.islammessage.com
http://www.onislam.net/

Another aspect associated with water in the Quran is its purifying power. Several verses focus on the subject of purification and personal cleanliness like the following: "It is He who sends down water upon you from the sky with which to purify you". (Sura of Booty 8,11)

Water has always had a special place in the Islamic religion, with the Messenger of Allah once overheard saying: "The best form of sadaqah [charity] is giving someone water." ■







ENERGY EFFICIENCY AND CONSERVATION

ARTICLE

By Rashed Khalifa Al Shaali

Energy conservation and efficiency are essential pillars of economic development, a fact recognised by the UAE. On this basis, a focus on these areas can act as a way to address the sustained rapid growth in energy demand and complement the UAE's renewable energy ambitions. Compared with investments in renewable energy, energy conservation and efficiency projects are the low-hanging fruit, requiring minimal funding to be implemented and often yielding faster results.

The UAE Vision 2021 clearly supports energy conservation and efficiency efforts as an important contribution towards preserving the country's resources. The Ministry of Energy recently underwent a restructuring exercise to achieve these goals that will safeguard the energy sector. The Ministry's new focus is to enhance what has already been initiated across the Emirates, as well as drive new initiatives within these areas.

In terms of opportunities, the building sector provides the biggest potential for energy savings, as buildings consume the largest share of electricity in the UAE. This is the reason most efficiency initiatives to date have focused on this sector. Water efficiency is also a major aspect of the drive to save energy, due to the fact that upwards of 90 per cent of the country's potable water is produced through energy-intensive desalination processes.

Abu Dhabi and Dubai have driven the effort to make buildings more efficient. In Abu Dhabi, the Urban Planning Council launched the Estidama building rating system in November 2010. The system rates buildings' efficiency on a ranking of one pearl – the lowest, to five – the highest. The system is compulsory and requires all buildings to meet basic requirements to achieve the lowest rating. Government buildings are required to achieve a minimum of two pearls. Up until April 2014, buildings representing a gross floor area of 1.2 million square metres were all completed in accordance with Estidama, with five-times more under construction. Other government departments such as the Environment Agency – Abu Dhabi, the Executive Council and the Regulation and Supervision Bureau, as well as clean energy company, Masdar, have also launched initiatives to identify opportunities for large-scale energy savings, pilot new approaches and technologies, and educate the public about the need to conserve resources.

In October 2007, HH Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, issued a resolution to implement green building specifications and standards in new buildings. Following this, in 2009, Dubai Municipality started work on new regulations for the building sector. These were developed in conjunction with the Dubai Electricity and Water Authority (DEWA). As a result of this process, Dubai's Green Building Regulations and Specifications were introduced, initially in regards to new government buildings and on a voluntary basis for the rest of the sector. In 2014, the building code became mandatory for all new buildings in the Emirate.

At the federal level, the Emirates Authority for Standardisation and Metrology (ESMA) promotes the use of efficient electrical equipment. In 2012, it launched an efficiency labelling scheme for window and split-unit air-conditioning systems, eliminating highly inefficient units from the market. Since July 2014, ESMA has also banned the import of inefficient incandescent light bulbs. The scheme is expected to cut energy use by 500MW per year.

The Ministry of Energy is also playing a proactive role. Energy efficiency will be a key priority in the national energy policy currently being drafted by the Ministry with input from relevant stakeholders. The policy will provide the framework to enhance what is already underway at the local level, as well as to measure and benchmark ongoing progress in a coordinated manner.

In July 2014, the Ministry of Energy established a new department for energy conservation and energy efficiency. One of the goals of this department is to establish a database of energy consumption by different sectors across the UAE. This is to establish a local benchmark that allows for comparisons to be made between establishments within a sector.

> "Local and federal authorities in the UAE have implemented a number of steps to date to ensure the efficient use of energy and water, establishing the UAE as a regional leader."

The database will study the performance of different establishments – government buildings such as schools and hospitals, office buildings, and hotels, as well as residential units such as villas and high-rises. This database will be an important tool in the evaluation of green design. While the UAE has seen a steady number of green building projects in recent years, little information is available on their subsequent performance. The lack of data represents a missed opportunity to effectively learn from existing projects.

In addition to measuring performance in terms of energy and water use per square metre, the database will consider factors such as the current stage of a building in its lifecycle, and the number of occupants in each building. The former is particularly important when considering the UAE's climatic conditions, while the latter is relevant when assessing the performance of residential buildings, which have a different profile in the UAE compared with Western countries where most studies are currently performed. Families in the UAE are larger than in many other countries, particularly in Europe and North America, which may partially account for the high use of water and energy per square metre of space in UAE residences. Given the cultural considerations within the UAE and the harsh climate, a locally-developed database and building efficiency benchmarks could be useful tools across the GCC.

An additional important step is to create a federal green building code, and speeding up the adoption of efficient building technologies in all of the Emirates that make up the UAE.

Local and federal authorities in the UAE have implemented a number of steps to date to ensure the efficient use of energy and water, establishing the UAE as a regional leader. The Government is keen to further this approach as an essential part of its development plans and the Ministry of Energy will take an active role in achieving the goals of the energy vision for the UAE. ■

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EMIRATES NATIONAL GRID (ENG)



ARTICLE

By Dr. Mohamed L. Awad

Background

The United Arab Emirates is a federal country comprising seven Emirates, with Abu Dhabi as its capital. Four separate power authorities have been established to deal with water and electricity matters in the Emirates. These are:

- Abu Dhabi Water and Electricity Authority (ADWEA) for the Abu Dhabi Emirate;
- Dubai Electricity and Water Authority (DEWA) for the Dubai Emirate;
- Sharjah Electricity and Water Authority (SEWA) for the Sharjah Emirate; and
- Federal Electricity and Water Authority (FEWA) for the four northern Emirates (Ajman, Umm Al Quwain, Ras Al Khaimah and Fujairah).

Each authority is established and governed under a separate set of laws setting out its rights and responsibilities within the Emirate.

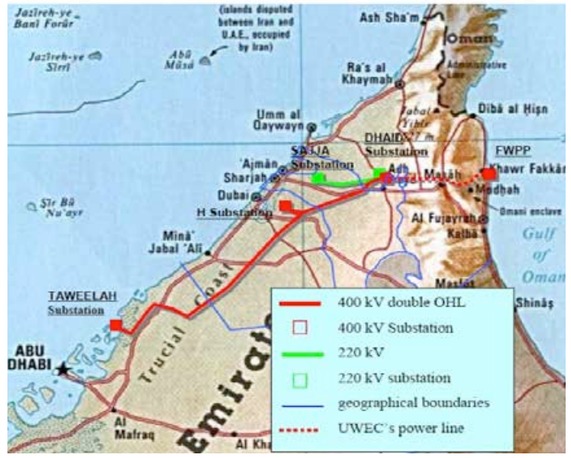
These four authorities under the patronage of the UAE's Federal Ministry of Energy decided to connect their power systems through a high-voltage transmission backbone called the Emirates National grid (ENG). ENG's first mission was to provide the flexibility to exchange electrical power between the different authorities, thereby improving network stability and providing a more reliable power supply for customers. It was also envisioned that ENG would support the development of economic activity through the more effective use of energy resources across these four authorities, developing a coherent national grid which is a prerequisite for UAE participation in the regional grid planned by the Gulf Cooperation Council (GCC).

> "One of the main advantages of the ENG project is the financial savings as a result of the reduction in installed reserve capacity on each of the individual utility systems."

1. Phases of Implementation of ENG

- Feasibility, economic and technical studies were completed in 2002 and project commissioning started in 2004
- In May 2006, the DEWA network was connected to the TRANSCO network. The TRANSCO network is the part of the transmission lines that belongs to TRANSCO, which is connected to other authorities' networks through the ENG. DEWA was connected to the network through one 400kV double overhead line (OHL) between Taweela 400 kV substation in the ADWEA system and the DEWA 400 kV Warsan substation. The line length is almost 131kms. The commissioning of this part of the grid interconnected DEWA and ADWEA networks.
- In May 2007, one 400kV double OHL between Warsan substation and Dhaid substations (69kms) and one 220 kV double OHL between Dhaid substation and Sajja substation in SEWA (36kms) were put into operation. The Dhaid substation was originally equipped with two 400/220 kV 500 MVA transformers. The commissioning of this part of the grid connected the SEWA system with the rest of the ENG network.
- Connection to the FEWA network through the DHAID 220/132kV transformer was completed in February 2008
- A third TRANSFORMER 500 MVA 400/220 KV was commissioned at DHAID substation in April 2009 connected to the GCC (Gulf Cooperation Council) Network through ADWEA on March 2011

The figure below shows the geographical locations of the ENG grid.



2. Formation of the Emirates Monitoring Centre (EMC)

To perform all of the coordination activities necessary to ensure the secure operation of ENG, an independent system coordinator; the ENG Monitoring Centre (EMC), was established. The purpose of the EMC is twofold:

- Creation of a coordination entity which is independent from the interests of organisations participating in the competitive marketplace;
- Assignment of the grid coordination activities to a single, independent entity.

The EMC coordinates the information collected by the individual authorities, calculates the current network conditions and possible future bottlenecks, and proposes measures to improve security levels and optimal operation modes. In addition, the EMC provides several grid-related services, such as maintaining telecommunication infrastructure, measuring quality aspects of network operation and providing platforms for information exchange among utility control centres.

3. Developing Interconnection Code

Part of the development of the ENG was to develop the "Interconnection Code" ¬¬- a comprehensive collection of relevant technical and commercial rules to ensure transparent and consistent operation of the ENG and to provide a clear framework for its possible expansion. The code consisted of five main components which are Operation, Trading, Planning, Interconnection and Multilateral Agreement.

4. The Main Advantages of ENG

One of the main advantages of the ENG project is the financial savings as a result of the reduction in installed reserve capacity on each of the individual utility systems. It also enables the commercial transfer of electricity between the authorities. Such commercial transfers can be conducted in various formats and for a variety of durations, lasting from relatively short periods to longer transfer arrangements. The level of exchange since commissioning the ENG project has reached up to 800MW on an almost continual basis.

In addition, the ENG interconnected system provides a stronger capacity to withstand major or sudden disturbances, such as the loss of production units and failure of grid elements, whether due to outages or natural catastrophes, as well as several types of crises. ■

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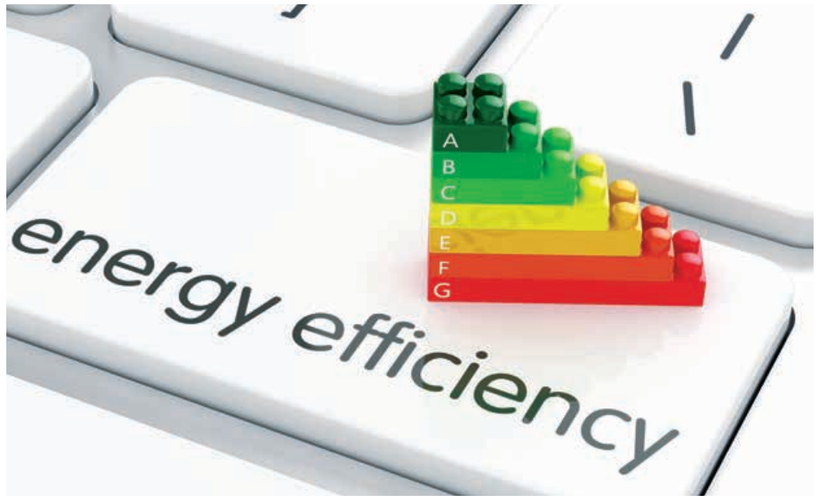


THE UAE IS GEARING UP FOR MORE ENERGY EFFICIENCY

ARTICLE

By Michael Sachse

HOW OTHER COUNTRIES ARE STRUCTURING THEIR EE POLICIES TO MEET AGGRESSIVE SAVINGS GOALS AND ENERGY TARGETS.



The UAE has been very ambitious in its efforts to develop sustainably. In Abu Dhabi the Regulation and Supervision Bureau is actively working with residents to reduce electricity and water demand and in Dubai, the centrepiece of Dubai's Integrated Energy Strategy -- a 30 per cent decrease in energy demand below 1990 levels -- will be a major challenge. The question of how these targets can be met has been a source of apprehension for some.

Across recent decades, efficiency programmes have focused mainly on structural programmes with the aim of increasing consumers' purchases of more efficient appliances and insulating their homes. However, recent innovations in the combination of big data analytics with behaviour science principles have shown that there is arguably more efficiency potential in behavioural programs. By prompting individuals with simple-to-understand insights into their energy usage, coupled with personalised tips to save energy, behavioural programs can enable people to cause significant and sustained reductions in energy usage.

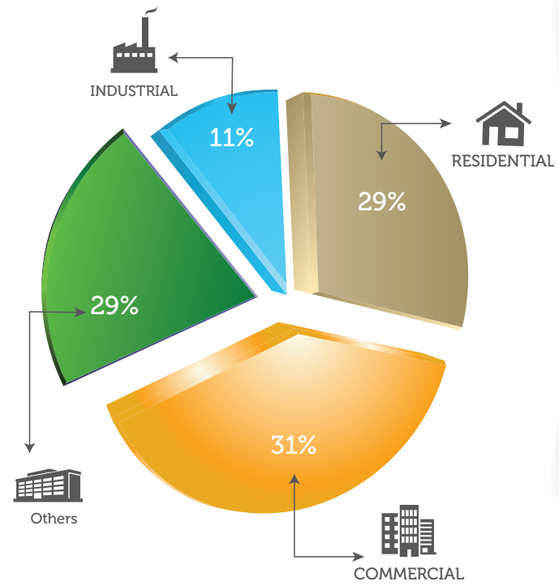
Recent research has estimated that approximately 20 per cent of residential energy consumption is currently wasted because of inefficient behaviour. Dubai has some of the highest residential energy use in the world, with average household use five times higher than the United Kingdom. If Dubai captured this 20 per- cent, consumers could save more than 1.9 terawatt hours (TWh) and over $150 million while reducing CO2 emissions by 1.1 million tonnes – the emissions equivalent of more than 3 million barrels of oil. The good news is that we are seeing an increasing number of efficiency success stories around the world. For example, countries such as Italy, Denmark, France and Germany have delivered both significant reductions in energy consumption and lifts in energy productivity through progressive policy development and implementation.

For example, between 1990 and 2011 Denmark grew its economy by 39 per cent. Logic would make one assume that energy consumption grew at a similar linear rate. However gross energy consumption was seen to fall by 1 per cent, primarily due to investment programmes in building and power plant efficiency, proof that energy savings can be attained without slowing economic growth. What next for Denmark? In November 2013, the Danish Energy Agency ratified an important new element in its climate change mitigation strategy: behavioural energy efficiency. Perceived wisdom had stated that motivating consumers to modify their energy use habits is very hard. But recent innovations in behavioural science and user-centric design have consigned that view to history. By delivering personalised energy insights and advice to customers through preferred communication channels, utilities are showing they can motivate them to save energy. Opower's own solutions have helped over 90 utilities around the world drive over 5 billion kilowatt-hours of energy savings – that's more energy than the Hoover Dam produces each year.

Energy efficiency has been, and will continue to be, a major driver in meeting the Integrated Energy Strategy targets in Dubai as well as other energy and sustainability targets around the world. Behavioural energy efficiency represents a tremendous energy savings opportunity – a savings opportunity that waits to be unlocked. ■

> "When efficiency programmes were introduced in the 1970s, they (...) encouraged consumers to purchase more efficient appliances and insulate their homes"

UAE Electricity Consumption 2013



SOURCE: Ministry of Energy

ABOUT MICHAEL SACHSE



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LINKS

Visit the interactive and entertaining websites of RSB and find out about the POWERWISE and WATERWISE initiatives http://www.powerwise.gov.ae/en and http://www.waterwise.gov.ae/en

CREATING THE WORKFORCE FOR VISION 2021: THE CARBON AMBASSADORS

The UAE is striving to enhance its role as a global hub for renewable energy research and development, as outlined in the nation's strategic plan Vision 2021. A vital component of this is to integrate sustainable development into the DNA of the nation. In recognition of the role education can play, the Dubai Carbon Centre of Excellence (DCCE) in conjunction with Dubai Electricity and Water Authority (DEWA) launched an empowerment programme called "Carbon Ambassadors" at the Water, Energy, Technology, and Environment Exhibition (WETEX) 2014 in April. The first intake of 40 university students has been inducted, and they are already being trained on sustainable development, the reduction of carbon emissions, and developing a green economy through workshops and activities designed to build social awareness. While the youth engagement and advocacy programme is open to students of all nationalities, Emiratis are well-represented. The programme is supported by the United Nations Development Programme (UNDP), the Ministry of Foreign Affairs (MoFA) and DP World, which is leading the turn-key project of repurposing a discarded shipping container into a self-sustainable bus stop.

Throughout the year, Carbon Ambassadors participate in a series of integrated activities, divided into three key themes: Sustainability, carbon emission reductions, and mitigation and adaptation. The themes will be explored through role-play, discussions, workshops, presentations and film screenings, as well as site visits, competitions and extracurricular projects designed to cultivate the participant's capacity for critical thinking, creative collaboration, and confident, constructive communication on these topical issues.

The Carbon Ambassadors are expected to become tomorrow's green workforce and spokespersons. DCCE will support dedicated and passionate Carbon Ambassadors in moving into positions within the industry and the programme will feature a networking and alumni component to extend the programme's momentum. ■



ENERGY AWARDS MADE IN THE UAE

> The annual US$4 million prize recognises noteworthy projects and the brains behind them across various pillars of society.

ARTICLE

HOW THE UAE IS AWARDING AND REWARDING INNOVATION AND EXCELLENCE IN THE ENERGY SECTOR

The quest for sustainability is setting the wheels in motion for a thriving, competitive landscape in the UAE and beyond. The key to progress, especially in a recovering and stabilising economy, is innovation. Multiple stakeholders carry equal responsibility for introducing and developing unique, path-defining projects, and carrying out committed and focused research.

Large multinational organisations are powerhouses in promoting widespread change. Recognising the role these companies play in stimulating economic growth in a highly competitive open economy is one of the first steps governments can take in encouraging sustainability. A number of companies have established strong footholds in the Middle East by building on their global reputations as initiators of sustainable-energy solutions. By adapting their portfolios for the region's requirements, they stand out as beacons of hope in a focused local energy-solutions market.

Smaller companies bring different strengths in influencing and creating locally relevant innovations. These stakeholders are often the ones who can benefit the most from capital funding. Armed with unique, creative solutions, SMEs have their ears to the ground and are generally the first to pick up on trends, obstacles to growth and other barriers, propelling them to develop distinctive solutions to overcome these challenges.

Other stakeholders include individuals who have demonstrated a lifelong commitment to accessible sustainable energy, and the youth who can flourish with guidance, encouragement and the right tools in the coming decades.

The new role for governments is to regulate, motivate and tie all these pillars of society together under a central vision, in order to create a constantly evolving backdrop for long-term socio-economic growth.

> In 2014, the [Zayed Future Energy Prize] received submissions from 88 countries.



Beyond the Bottom Line

Global leaders face many challenges when charting their nations' destinies, having to look beyond the economic value of innovative projects and solutions across multiple sectors and industries. Supporting and encouraging the spirit of innovation requires a departure from traditional cost-benefit analyses - the consensus is that innovators are not motivated solely by money. Recognition is its own reward, as is the support of key entities. Innovation primarily involves problem solving, a process which in itself stimulates creative thought and confidence in those with the dedication and motivation to provide benefits for society as a whole.



> The Government of Dubai through the Dubai Supreme Council of Energy has recently established the Emirates Energy Award (EEA) as a regional, biannual prize.

Over the past six years, the Zayed Future Energy Prize has emerged as the world's pre-eminent award for innovation in renewable energy and sustainability. In this short time, the prize has recognised over 30 innovators making a mark in the field of global sustainability, with winners, finalists and other entrants making a significant positive impact on the environment with their barrier-breaking solutions. The annual USD 4 million prize recognises noteworthy projects, and the brains behind them, across various pillars of society, from large corporations, small and medium-sized enterprises, non-governmental and not-for-profit organisations and individuals who have dedicated their lifetime towards sustainability, to high schools around the world that have actively moulded their learning environments and curricula around green principles.

In 2014, the prize received submissions from 88 countries, and building on this success, this year the prize committee has reached out with a worldwide campaign to drive awareness and promote submissions to achieve a record-breaking year. From a sustainability roadshow in Japan to participation in this year's Bloomberg New Energy Finance Summit in New York, the prize is on the fast track to empower those deserving of start-up capital across the world.

The Zayed Future Energy Prize has a rigorous application process, with three separate committees to select, review and judge each entry in order to maintain the objectivity and integrity of the prize.

Named after the father of the UAE, the Zayed Future Energy Prize encapsulates the vision that led the late Sheikh Zayed to carve a sustainable future for the nation and the world at large. The prize is founded on the spirit of collaboration, knowledge-exchange, leading by example and promoting innovation. → http://www.zayedfutureenergyprize.com/en/

Following the same principles, the Government of Dubai through the Supreme Council of Energy has recently established the Emirates Energy Award (EEA) as a regional, biannual prize awarded to encourage the rationalised use of energy and resources. It recognises the efforts of the public and private sectors across the region in energy efficiency, energy projects and education and research in the energy sector, as well as outstanding contributors within the field. First awarded in 2013, entities including Morocco-based NAREVA Holding, the Emirates Integrated Telecommunications Company, du and Masdar, amongst others, were recognised for their outstanding achievements with prizes totalling USD 1 million. → http://www.emiratesenergyaward.com

The path to sustainable growth holds many challenges, which can be viewed as opportunities to further a common goal between nations when innovation is fostered. The UAE has high hopes that the establishment of an award system will assist in supporting the ever-changing, nascent spheres of renewable energy and sustainability and support the forces and innovators behind it. ■

ZAYED FUTURE ENERGY PRIZE

جائزة الإمارات للطاقة
EMIRATES ENERGY AWARD

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هيئة كهرباء ومياه دبي
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02

CLEAN & RENEWABLE ENERGY

HIS EXCELLENCY
DR. SULTAN AL JABER

UAE MINISTER OF STATE & CHAIRMAN OF MASDAR



The United Arab Emirates (UAE) has enjoyed robust economic growth of 10 per cent annually since 2006. Our strong economic growth trajectory has been matched by a rising domestic demand for energy, registering at more than 9 per cent annually. To continue sustaining our growing economy and the long term energy demand it requires, the UAE has adopted a diversification strategy across energy sources that extends beyond oil and gas, and embraces renewables and nuclear power. It is the foresight and ambition of the UAE's leadership that is powering the country forward in pursuing this bold vision of our energy future.

Diversification of our energy supply mix has come with the added advantage of creating opportunities domestically by attracting and fostering greater expertise and knowhow, creating employment opportunities and significant inflow of investment and income into the country. The benefits of the diversification of our energy mix are nowhere more apparent than in the Shams 1 project. Shams 1, Abu Dhabi's 100 megawatt solar facility, is one of the largest concentrated solar power (CSP) plants in the world. It effectively displaces approximately 175,000 tons of carbon dioxide annually—the equivalent of planting 1.5 million trees or removing 15,000 cars from the roads. The sheer scale of Shams 1 means that the United Arab Emirates (UAE) now ranks the third globally, behind only Spain and the United States, in terms of installed concentrated solar power capacity. Through Shams 1, Masdar is providing reliable clean energy across the UAE, while also helping address longer term national energy objectives in the process. In parallel, our nuclear energy program is expected to meet nearly 25 percent of our country's energy needs by 2020, with the first facility planned to come online in 2017.

The UAE also remains an energy leader on the global stage. The wise foresight and stewardship of our political leadership over past decades ensures that the UAE continues to be a key player today in world energy markets as a leading OPEC oil producing nation. Yet with influence also comes responsibility, and so we are working to not only help ourselves but partners across the globe to navigate and benefit from the changing dynamics of energy in the 21st century.

The UAE's interests in renewable energy stretches well beyond our borders. Through Masdar, the UAE owns a 20 percent stake in the London Array offshore wind farm off the coast of the UK which remains the largest project of its kind in the world. Masdar is also a partner in a whole range of other clean energy projects in countries such as Spain, the Seychelles and Jordan, to name just a few examples. In total, it has close to just under 1 gigawatt of renewable energy generation capacity in operation globally.

In pursuing a more diversified energy future, the UAE is therefore also opening a new window of economic opportunity. In just a few years, pursuit of a broader energy portfolio has transformed the country into a truly global energy player.

THE UAE'S PATH TO CLEAN ENERGY



MAIN REPORT

By HE Eng. Waleed Salman

The UAE's rapid rise to become an international hub for tourism, trade, and now renewable energy, is nothing if not a natural progression. What now stand as major cities in the UAE were powered in the past, and years before the union, by traditional and sustainable renewable-energy sources. Barajils, or wind towers, still stand proudly against the UAE's double-glazed high-rise buildings as an icon of the region's architectural heritage. Centuries ago, these used to channel the shifting desert winds to cool houses, providing relief in the harsh summer months. Our ancestors were resilient, industrious and innovative. Fuelled by our rich heritage, we continue to forge ahead, adapting to the challenges of the 21st century.

Inspired by the leadership vision towards sustainability, the UAE is stepping up efforts to improve energy efficiency, while advancing the role of renewable resources in meeting these demands.

Despite the critical role of oil and gas for the UAE, the country has made groundbreaking commitments to alternative energy, taking major steps to reduce carbon emissions through large-scale initiatives in both Abu Dhabi and Dubai.

Since the establishment of the Federation, the UAE has been a regional powerhouse in innovative development strategies. By 2020, Abu Dhabi aims to derive 7 per cent of its energy from renewable sources, while Dubai has set a similar target of 5 per cent by 2030. Overall the UAE will generate 24 per cent of its energy from clean, low-carbon sources by 2021, the majority of which will come from nuclear facilities currently under construction. As the only country in the region to have implemented renewables on a large scale, supported by a new regulatory framework, we are ready to lead by example.

Aligning Energy Policies to the UAE Vision 2021

The President of the UAE, His Highness Shaikh Khalifa bin Zayed Al Nahyan, and Vice President and Prime Minister of the UAE, and Ruler of Dubai, His Highness Sheikh Mohammed bin Rashid Al Maktoum, have outlined the UAE Vision 2021 to establish our country among the leading nations in the world in the next seven years.

The selection of Abu Dhabi to host the global headquarters of the International Renewable Energy Agency (IRENA) reinforces our position as an emerging hub for renewable energy, and reaffirms the contribution to the global renewable-energy industry. The individual emirates are working towards making the national target of 24 per cent a reality.

Abu Dhabi – through Masdar – continues to channel considerable resources to the advancement and adoption of renewable energy. Along with providing substantial funding to IRENA and working towards a 7 per cent renewable-energy target by 2020, the Abu Dhabi Fund for Development has offered US$50 million in annual loans to finance renewable-energy projects in developing countries.

In January 2012, the Mohammed Bin Rashid Solar Park Mega Project was launched – the biggest of its kind in the region with a full capacity of 1,000 MW. In addition to electricity generation, the park will have:

- An advanced innovation centre
- An R&D centre
- A solar-testing facility
- A specialised academy

In Dubai, the Dubai Integrated Energy Strategy 2030 (DIES) was announced in 2011 to set the strategic direction towards securing a sustainable supply of energy and enhancing demand efficiency for all resources under the visionary leadership of Sheikh Mohammed bin Rashid Al Maktoum. The DIES 2030 action plan aims to reduce energy demand by 30 per cent by 2030 while diversifying Dubai's energy mix, of which 71 per cent will come from natural gas, 24 per cent from nuclear and clean coal, and 5 per cent from solar energy.

Vision 2021 is a holistic call to action for every sector and industry in the UAE. The local energy-diversification strategies overlap with Vision 2021 in areas related to energy and sustainability, such as the sustainable use of resources, waste to energy conversion, clean and secure sources of energy, water security, and sustainable transport.

Collaboration at the Core

The renewable energy sector is now a trillion-dollar global industry, and the UAE is on the fast track to reap the benefits from investing in domestic solar infrastructure. Moving forward, the responsibility will shift from legislators, regulators and public-sector agencies, to private companies, who can provide capital and takes in the projects and their guaranteed returns. This is where public-private partnerships (PPP) can play a critical role.

In Abu Dhabi, Shams 1 CSP plant is a crowning example of a successful multi-stakeholder venture, between Mubadala, France's Total and Spain's Abengoa. The Abu Dhabi Water and Electricity Authority (Adwea) utilises this PPP structure for several of its power projects, recognising the advantages of collaboration on utility-scale developments. Since its launch, Shams 1 has been generating enough electricity to power 20,000 homes, while reducing carbon by 175,000 tonnes per annum, according to Masdar. As a result of this dedicated effort to champion solar energy in he UAE, we now rank third in the world in CSP generation (REN21 2014).

> "Vision 2021 is a holistic call to action for every sector and industry in the UAE."

CO_2

Shams 1 reduces carbon emissions by **175,000 tonnes per annum**



In the PV market, Dubai's Mohammed bin Rashid Al Maktoum Solar Park has successfully completed phase one, a 13 MW-PV facility that produces 24 million KWh of energy and reduces carbon dioxide by 15,000 tonnes per year. The solar park's second phase (a 100 MW PV facility estimated at AED 700 million) will also be developed in a public-private partnership, in which DEWA will hold 51 per cent

Fuelled by Knowledge

Under Vision 2021, the UAE is on a fast track to develop a knowledge-led economy, investing in its human capital and the potential to develop a competitive advantage in specific sectors. By 2021, our ambition is that the knowledge sector will contribute up to 5 per cent of the country's GDP.

Beyond being a pioneering project in solar-power generation, the Mohammed bin Rashid Al Maktoum Solar Park also includes a research, development and innovation centre, dedicated to scaling renewable-energy technologies and energy-efficiency practices. The centre, set to open in 2017, will also serve as an academy for renewable energy. In addition, the solar park will include a test facility for solar-panel manufacturers to test their units for behaviour and performance quality when connected to the grid onsite. Trial and error is the basis for successful innovation, and we believe an all-inclusive solar park, supporting research, testing and progress, can help build a thriving solar industry.

Our future hinges on developing UAE nationals and residents who are qualified and experienced in planning, developing and enhancing the nation's energy sector. Abu Dhabi's Masdar Institute of Science and Technology, now in its fifth year, is a beacon for research and development in renewable energy and sustainable industries in the UAE. Along with its rigorous screening processes in selecting the best and brightest minds from around the world, the academic programmes include theoretical and practical courses to produce future knowledge-leaders in the field of renewable energy.

The institute's Young Future Energy Leaders programme has been a key element of the World Future Energy Summit, held annually in Abu Dhabi. This highly selective programme places up-and-coming professionals in alternative energy with world-leading companies to discuss the latest developments, challenges and opportunities ahead.

The recently launched UAE-wide Carbon Ambassador Programme builds capacity and more importantly is generating interest among university students to pursue careers within the green economy. In the year-long programme, approximately 40 students complete a group project – such as redeveloping a discarded shipping container as a sustainable bus shelter – and undergo a number of training modules, representing the UAE at national and international conferences.



Dubai's Mohammed bin Rashid Al Maktoum Solar Park produces
24 million KWh of energy per year

> The recently launched UAE-wide Carbon Ambassador Programme builds capacity (...) among university students to pursue careers within the green economy

The Road to Success

Clear and consistent leadership decisions have guided the UAE well so far, and moving forward, federal and local governments will be central to enabling a vibrant business and trading climate, and ensuring world-class infrastructure for education, healthcare and transportation.

The federal government has made numerous commitments to strengthen the UAE's macroeconomic foundations while reforming its regulatory environment and investing heavily in human capital. These commitments and targets aim to develop sustainable growth of the country's non-oil sector. Beyond the immediate challenges, countless opportunities lie ahead for the UAE to establish a sustainable economy that benefits our citizens by providing abundant job opportunities in a diversified environment. Market barriers are many and varied in the private sector, including lack of awareness, risk aversion, and short-sighted business models. Our role as a public-sector entity lies in breaking through these barriers to revive the same aspirational spirit and audacity that propelled our forefathers many decades ago.

With the future in mind, we are prepared to continue our long-standing tradition of responsible energy stewardship. ■



By 2021, UAE's ambition is that the knowledge sector will contribute up to
5% of the country's GDP.

ABOUT HE ENG. WALEED SALMAN



HE Eng. Waleed Salman is the Executive Vice President for Strategy and Business Development at DEWA, Chairman of the Board of Directors of Dubai Carbon Centre of Excellence and the Secretary General and Vice-Chairman of the World Green Economy Summit. As a member of the Dubai Supreme Council of Energy, he is an advocate for sustainable business practices.



INTERVIEW

INTERVIEW:

HE SAEED AL TAYER

Managing Director & CEO of Dubai Electricity & Water Authority

هيئة كهرباء ومياه دبي
Dubai Electricity & Water Authority

Earlier this year, DEWA pledged to introduce smart initiatives in three specific areas in line with Dubai's evolution to become a smart city: small-scale use of solar panels, smart meters and electrical vehicle charging stations. Can you elaborate on these smart initiatives? How can these measures help Dubai transition into a connected, intuitive and efficient (smart) city?

DEWA has introduced three initiatives to support the vision of HH Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, for Dubai to become the smartest city in the world. These three initiatives will bring greater utility and awareness to Dubai's citizens and residents.

The first initiative will enable residents and property-owners to generate their own electricity by installing solar panels within their properties to provide clean, renewable energy for their homes and businesses with any surplus energy being exported to DEWA's power grid.

The second initiative will see the transformation of existing electricity and water meters into smart meters, which will provide regular updates for customers on how much they consume each month. This data will be available through smart-phone applications to enable customers to make informed decisions about how they can further reduce their bills.

The third initiative will see the construction of vehicle-charging stations for electric vehicles to provide the required infrastructure to encourage the use of non-polluting vehicles in Dubai.

These measures will directly contribute towards Dubai's transformation to become the smartest city in the world. DEWA is also contributing to this, with the delivery of smart services through smartphone and smart tablet applications that provide customers and residents with access to DEWA's services on a 24-hour a day, seven days a week basis.

> "DEWA will enable the connection of distributed solar panels into the DEWA grid under the Distributed Renewable Resources Programme."

What support are you providing to encourage the use of solar panels?

DEWA will enable the connection of distributed solar panels into the DEWA grid under the Distributed Renewable Resources Programme. This initiative will encourage households and building owners to install photovoltaic solar panels to produce electricity and use it within their own premises for private consumption, with the surplus to be exported to DEWA's grid. The installation of solar panels will contribute in diversifying Dubai's energy sources and supporting the Green Economy and Sustainable Development initiative announced by HH Sheikh Mohammed bin Rashid Al Maktoum. It also complements the Dubai Integrated Energy Strategy 2030, which aims to reduce energy demand by 30 per cent by 2030, and to diversify the energy mix of the Emirate, with 5 per cent from solar power. The regulatory framework governing the Distributed Renewable Resources Programme, including technical standards for the equipment and connection procedures, are currently being finalised, and this will enable the first pilot connections over the coming few months. Customers can express their interest through DEWA's "One Window Application", which will also be used to manage customer interactions within the programme, once it is fully implemented.

> "Customers can express their interest through DEWA's "One Window Application", which will also be used to manage customer interactions within the programme, once it is fully implemented"

How do smart meters help you manage the grid?

DEWA is implementing its smart-grid strategy to create a network that will manage the development of new services and energy technologies and enhance network management, to enable Dubai's residents to better control their requirements for energy and water. DEWA has initiated a five-year plan to replace conventional mechanical and electromechanical meters with Smart Meters which will enable DEWA to provide various benefits and new applications to its customers, including automatic and detailed readings – both current and historical. The data obtained through these readings will be available to customers to monitor actual consumption over a specific period of time, enabling better understanding and management of bills. Additionally, such data will help identify energy-efficiency measures and will enable comparisons to be made. The Smart Meters will support the installation of renewable sources of energy in residential, commercial and industrial sectors, by comparing energy usage between consumption and generation. DEWA will install 200,000 Smart Meters over the next three years across Dubai, which will be connected to new advanced computerised systems and software. Work on the first stage has already started and is expected to be completed before the close of 2015.

Recent reports have stated that DEWA has invested in energy assets ahead of Expo 2020. What kind of infrastructure developments can we expect from this? How will this help meet the projected demand by 2020?

Dubai's achievement in winning the bid to host the World Expo 2020 reiterates its leading position as a global city committed to the prosperity of future generations. The UAE closely reflects Expo 2020's values with its colourful cultural diversity bringing together over 200 nationalities living and working in harmony in a safe and nurturing environment, without discrimination.

DEWA contributed to the UAE's bid for Expo 2020 by completing various sustainable projects, adopting the Dubai Integrated Energy Strategy 2030, and reflecting energy innovation in its strategy and plans. DEWA has organised events and activities at both the national and international level, to support Dubai's bid to host Expo 2020. These included promoting Dubai's profile at international conferences and featuring the official Expo 2020 bid logo across all DEWA buildings and in all internal and external publications.

Currently, DEWA has sufficient installed capacity for electricity and water and we are working on enhancing this capacity, with future plans including expanding transmission and distribution networks.

DEWA is able to provide electricity and water services to Expo 2020 that meet the highest international levels of efficiency and reliability, while meeting the growing demand for electricity and water across the Emirate. We are committed to collaborating with the relevant organisations to contribute to the success of Expo 2020 and promote Dubai's pioneering international position. ■

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RENEWABLE ENERGY EXPORTED

RENEWABLE ENERGY AS DEVELOPMENT ASSISTANCE

ARTICLE

By Dane McQueen



Foreign aid is a defining tradition in the UAE. The establishment of the country's aid programme preceded its independence in 1971. In 2013, the UAE spent 1.25 per cent of its gross national income as aid, making it the world's foremost donor according to the OECD.

Particularly eye-catching among the UAE aid portfolio is a new and growing focus: renewable energy. In 2013, the UAE allocated over $500 million of untied grants and soft loans for renewable energy projects in fellow developing countries, one of the sector's largest bilateral financial injections to date.

Renewable energy is seen as having an all-encompassing positive effect. It provides affordable power for countries' and communities' economies, while also creating new jobs, environmental benefits and energy security. The concessional finance also has the benefit of strengthening UAE capacity in renewable energy investment and development, which it expects to be critical for future energy leadership.

The UAE targets 'tipping point' countries, where renewable energy is already cost-competitive or cheaper than alternatives, but where lack of experience in the market limits its deployment. The idea is to normalize renewable energy, thereby lowering barriers for incremental projects.

The UAE's first fund, a special soft loan facility run by the Abu Dhabi Fund for Development (ADFD) in partnership with the International Renewable Energy Agency (IRENA), will disburse $350 million for generation projects in developing countries. In January 2014, during Abu Dhabi Sustainability Week, ADFD announced the first loan offers to Ecuador (small hydro), the Maldives (waste-to-energy), Mali (PV-diesel hybrid), Mauritania (wind), Samoa (biodiesel), and Sierra Leone (PV). The next round of loan offers will be announced in January 2015.

In 2013, Masdar also executed major grant-funded projects in Mauritania, the Seychelles, and Afghanistan. The 15 MW PV plant in Mauritania represented a 10 per cent increase in the country's generation capacity, as well as one of the MENA region's major renewable energy projects of the year. The 6 MW wind farm in the Seychelles is the first significant renewable energy installation in the country, which, like other islands, is characterized by both crippling energy prices and very high economic potential for renewable energy. The Afghan project brought reliable electricity to 23 remote villages for the first time. The UAE has also made a landmark investment in the Pacific in 2013, launching a $50 million grant fund for renewable energy generation projects. Masdar custom-designs facilities with Pacific governments, also providing feasibility studies and capacity-building. The first project under the fund, a 0.5 MW PV plant, was commissioned in Tonga, and the next project, a 0.6 MW wind installation in Samoa, is expected to come online in Q3 2014. Solar PV projects in Fiji, Kiribati, Tuvalu and Vanuatu are slated for completion in Q1 2015, and projects are currently being scoped in the Marshall Islands, Nauru, Palau and the Solomon Islands.

Commitments for larger scale renewable energy projects in Egypt and Morocco were additionally announced in 2013, with tenders underway already in Egypt. ■

ABOUT DANE MCQUEEN

He is an Energy Expert

REMAP 2030 AND THE RENEWABLE ENERGY OUTLOOK IN THE UAE

ARTICLE

By Deger Saygin and
Dr. Sgouris Sgouridis



THE TRANSITION FROM SUBSIDISED, FOSSIL-BASED POWER GENERATION TO A DIVERSE, SUSTAINABLE ENERGY MIX

In order to ensure a sustainable energy future, countries and regions around the world need to rapidly increase the deployment of renewable technologies. To highlight the potential and feasibility of such a transition, the International Renewable Energy Agency (IRENA) has prepared a global roadmap to guide the process up to 2030.

REmap 2030 provides a detailed analysis, based on official national sources, from 26 countries that together account for three quarters of global energy demand. Along with the world's largest economies, one of the countries analysed is the United Arab Emirates (UAE). IRENA has collaborated with the Abu Dhabi-based Masdar Institute to assess the country's renewable energy prospects. With currently existing technologies, the share of renewables in the global energy mix could be doubled to 36 per cent by 2030, without significant additional cost, thereby reducing emissions of carbon dioxide (CO_2) from fossil fuels and helping avert catastrophic climate change. The net investment needed to unlock sufficient renewable energy potential would be USD 265 billion per year. This is less than the support currently given to the fossil fuel industry which received subsidies of USD 544 billion globally in 2012, according to the International Energy Agency (IEA). The global REmap analysis also shows that if the health and environmental costs of pollution are also fully considered, switching to renewable energy would result in savings of up to USD 740 billion per year, as well as the creation of 900,000 additional direct jobs in the energy sector.

While countries with comparatively advanced deployment such as Denmark are positioned to achieve the highest shares of renewables in 2030, others such as the UAE can grow at fast rates and contribute significantly to the transition, even from a low starting point today.

ABOUT DEGER SAYGIN



IRENA Innovation and Technology Centre

ABOUT DR. SGOURIS SGOURIDIS



MASDAR Institute of Science and Technology

UAE Energy Profile

The UAE consists of seven emirates with a total population of 9.2 million (2012 estimate). According to the Worldbank, the country's annual nominal gross domestic product (GDP) was USD 383.3 billion in 2012, with a nominal GDP per capita of USD 41.691.

Although the economy, particularly in the emirate of Abu Dhabi, has historically relied heavily on oil-related industries, there is now a strong movement towards economic and energy sector diversification. While diversification was originally aimed at energy- intensive industries, such as aluminium smelting, it has progressed towards advanced technologies, such as semi-conductors, aerospace and renewable energy systems.

Energy consumption per capita in the UAE is among the highest in the world. This stems from the energy intensity of heavy industries; a social contract that has traditionally subsidised energy and water (thereby encouraging inefficient use), a hot and arid climate requiring air conditioning for more than half the year, and desalination for all urban water needs. In 2011, the UAE's primary energy consumption amounted to 3,650 petajoules (PJ) per year, with 35 per cent coming from oil and 35 per cent from gas. Per capita electricity consumption is approximately 12,500 kilowatt-hours (kWh) per year, putting the UAE in the top ten countries globally, with cooling, lighting, refrigeration and other appliances making up the bulk of electricity demand. Electricity demand is strongly seasonal, reflecting changes in ambient temperature and humidity. In Abu Dhabi, for example, the residential electricity load for cooling averages 47 per cent, but this can exceed 60 per cent at the summer peak.

> "With technologies existing today, the renewable share in the global energy mix could be doubled to 36 per cent by 2030 (...)"

The transport sector is dominated by private vehicles, but public transportation systems are being actively developed. Dubai operates the first metro system in the Gulf region, and Abu Dhabi is planning for a light-rail system.

Subsidised, Fossil-Based Power Generation

Based on estimates by the IEA, the UAE's expenditures on subsidies for fossil fuels reached USD 18.1 billion (55 per cent for gas; 30 per cent for electricity, which is mainly natural gas-based; and 15 per cent for oil) in 2010. Electricity and water prices are regulated on an emirate level.

Net electricity generation was 97.3 terawatt-hours (TWh) per year in 2010, from 23 gigawatts (GW) of installed power capacity. Most of this generation is from combined-cycle, co-generation thermal plants, where heat is used to desalinate water. Older, less efficient open-cycle plants are also operated to meet peak electricity demand. Thermal plants primarily use natural gas as fuel, switching to other petroleum products when gas is unavailable. There is now a programme to add 5.6 GW of nuclear power generation capacity.

In 2010, the UAE imported 17.60 billion standard cubic meters (bcm) of natural gas, or approximately 30 per cent of consumption, by pipeline from Qatar. This compares with gross domestic production of 79.78 bcm, of which 30.98 bcm went to industrial uses, 30.37 bcm was used for electricity and water desalination, 22.41 bcm was re-injected in oil fields, and 7.34 bcm exported. Power generation is projected to increase from 23 GW in 2010 to 52 GW in 2030.

In terms of liquid fuels, the UAE produced approximately 2.81 million barrels per day (bbl/d) of total oil liquids in 2010, of which 2.3 million bbl/d consisted of crude oil. Three quarters of total crude oil consumption is processed into petroleum products in refineries, mainly for use in the transport and industrial sectors (including non-energy uses). Consumption of petroleum products (other than natural gas) for power generation and in buildings is relatively small.

Solar and waste-to-energy projects dominate the country's current renewable energy plans. The table below provides an overview of the current situation and the existing plans to 2020 and 2030 in the emirates of Abu Dhabi and Dubai.

	Abu Dhabi	Dubai
2013 (year-end)	Masdar City PV – 10 MW (2009) Sir Bani Yas Wind – 28.8 MW Shams 1 CSP – 100 MW	Mohammad Bin Rashid Al Maktoum Dubai Solar Park PV, Phase 1 – 13 MW Installed rooftop buildings – 4 MW
2020	Noor 1 PV – 100 MW (in planning) Noor 2 PV – 150 MW (in planning) Waste-to-Energy – 100 MW (2016)	Mohammad Bin Rashid Al Maktoum Dubai Solar Park PV, Phase 2 – 130 MW
2030	No announcements	Mohammad Bin Rashid Al Maktoum Dubai Solar Park PV, Phase 3 – 1000 MW
Total	489 MW	1,147 MW

1 PJ equals 0.0239 million tonnes of oil equivalent (Mtoe).
1 bcm is equivalent to approximately 40 PJ.
Acronyms: MW: megawatt; PV: photovoltaic; CSP: concentrated solar power

> "If business continues as usual, 52 GW of power generation in 2030 would include 41 GW of gas, 5.6 GW of nuclear and 3.7 GW of solar power"

Today, power generation and water desalination in the UAE are often done together in natural gas power plants. This poses a distinct challenge for wider solar energy uptake, as water production would need to be de-coupled from more decentralised, solar photovoltaic (PV) power generation. Reverse osmosis offers another desalination method that could be used in parallel, while concentrated solar power (CSP) plants could produce desalinated water in combination with larger-scale, centralised power generation.

The UAE Roadmap

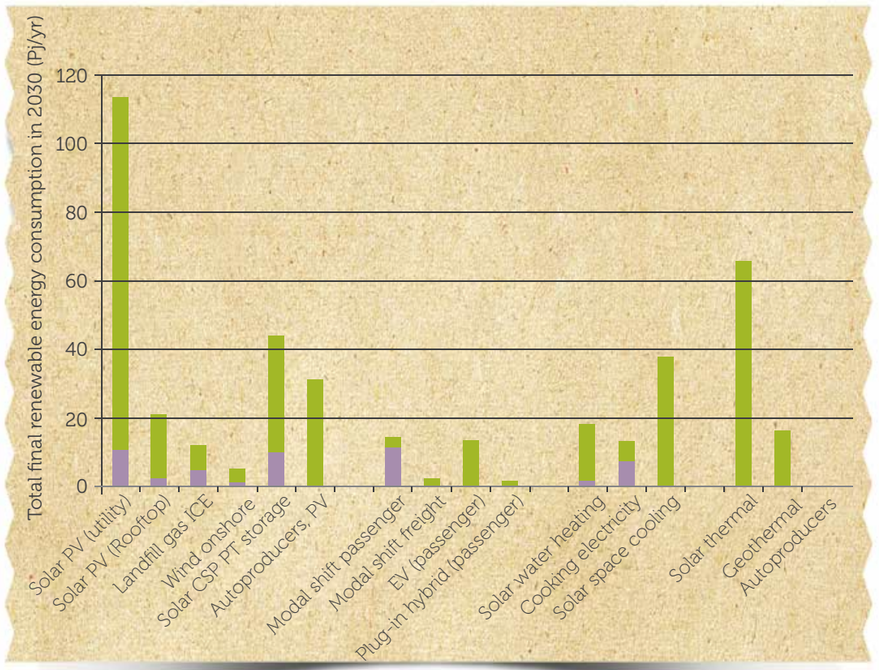
The figure below shows renewable energy consumption in 2030 according to the UAE Vision 2021. Different technologies are grouped by sector, starting with the power generation sector (left) and continuing with the transport, buildings and industrial sectors. With business as usual (indicated by blue bars), renewable energy use will remain very small in 2030 and mainly come from renewable power generation. Existing plans would result in 1 per cent renewable energy in the total UAE energy mix, compared to none in 2010. However, there is a considerable potential to go further, whether with utility and rooftop solar PV installation, CSP plants or solar thermal technologies in both buildings and industrial uses. If power came from renewable sources, fossil fuel dependence and carbon emissions could also be reduced through electrification in the transport sector, both with electric vehicles (EV) and increased public transport use. If all these possibilities are pursued, renewable energy could cover nearly 9 per cent of the UAE's TFEC in 2030.

Power generation accounts for three quarters of the additional renewable energy potential identified in the roadmap for the UAE. If business continues as usual, 52 GW of power generation in 2030 would include 41 GW of gas, 5.6 GW of nuclear and 3.7 GW of solar power. However, if the realisable potential of existing technologies is implemented, up to a quarter of total power generation in the UAE could come from renewables. Solar power generation would increase to 28.2 GW in 2030, and total power generation capacity would increase to 70 GW. Higher renewable power capacity would allow a decrease in gas capacity to 35.2 GW in 2030.

The UAE's renewable power generation options can be complemented with solar water heating (to cover 50 per cent of demand) and solar space cooling (10 per cent of demand). The renewable share in building energy use would increase to 26.1 per cent in 2030 (including the contribution of renewable power generation), instead of 3.5 per centbased on existing policies. Solar thermal could contribute 8 per cent and geothermal 2 per cent of industrial process heat, increasing the renewable share for industry to 5.2 per cent in 2030, instead of just 0.2 per cent based on existing policies. Only limited options have thus far been identified for scaling up renewables in the UAE transportation sector.

The total cost of implementing REmap options for the UAE would amount to between USD 1 and USD 7 per gigajoule (GJ) , depending on future gas prices, which translates into yearly costs between USD 0.4 billion and USD 2.8 billion by 2030. Total CO2 emissions would be 34 megatonnes (Mt) lower, or 9 per cent less than based on business as usual. If CO2 is priced at USD 25 per tonne, this translates into benefits of USD 0.7 billion per year. The more gas prices rise, the more scaling up renewables makes economic sense. Diversifying the energy supply also strengthens security of supply.

Despite a low starting point, the UAE can do far more than double its renewable energy use by 2030. By adopting the policies envisaged in REmap 2030, the country can contribute significantly to ensuring a sustainable global energy future. ■



Purple bars indicate final renewable energy use in 2030 from different technologies in the UAE, as expected based on current policies. Green bars indicate the additional potential of renewables beyond business as usual, if the right policies are adopted. PV = photovoltaic; ICE = internal combustion engine; PT = parabolic trough; EV = electric vehicle

IRENA published REmap 2030: A Renewable Energy Roadmap in June 2014. REmap 2030 provides a plan to double the share of renewable energy in the world's energy mix between 2010 and 2030. It determines the realistic potential for countries, regions and the world to scale up renewables in order to ensure a sustainable energy future. REmap 2030 is the first study of worldwide renewable energy potential assembled from the bottom up, starting with separate country analyses and then aggregating the results to arrive at global picture.

The countries analysed are: Australia, Brazil, Canada, China, Denmark, Ecuador, France, Germany, India, Indonesia, Italy, Japan, Malaysia, Mexico, Morocco, Nigeria, Russia, Saudi Arabia, South Africa, South Korea, Tonga, Turkey, Ukraine, the United Arab Emirates, the United Kingdom and the United States. Continual updates are available at www.irena.org.

Comprehensive results for the UAE can be found in a forthcoming REmap 2030 country report prepared by the Masdar Institute and IRENA, planned for publication in late 2014.

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GAS RECOVERY AT THE AL QUSAIS LANDFILL



FACT BOX

In January 2012, Dubai Municipality started construction of the emirate's first landfill gas collection system. Located at one of Dubai's largest landfills in Al Qusais, the project started operating in February 2013 and was officially launched in July the same year.

Underlining Dubai's vision to develop in a sustainable manner and to offer opportunities for green businesses, the project prevents a large amount of methane, a gas with high global warming potential, from being released into the atmosphere. It is the biggest project of its kind in the region and it is currently registered under the Clean Development Mechanism, a United Nations scheme which funds projects that combat climate change.

The Al Qusais landfill is fully functional. Every day, it receives around 5,000 tonnes of waste, more than half of the total amount produced in Dubai. The site covers 3.5 square kilometres and is 20 metres high. To help design and execute the project, Dubai Municipality contracted a local company, Green Energy Solutions & Sustainability. The company designed the network of horizontal and vertical pipes and wells that collects a total of 6,000 cubic metres of gas per hour. A total of 22 kilometres of pipes were laid underground.

The gas is collected via twelve collection chambers and is then burned in a flare. While the process results in the release of carbon dioxide (CO2) emissions, it has an overall beneficial effect on the environment by preventing the release of methane gas, which is 25 times more potent than CO2. Besides burning methane, the project also helps reduce bad odors from the landfill site.

Some of the landfill gas recovered is used to power a GE Jenbacher gas engine, which is capable of handling gas with as much as 60 per cent methane content, compared to natural gas which contains around 90 per cent methane. The system has the capacity to generate one megawatt (MW) of electricity that covers the landfill operation's energy needs. Al Quisais is the first landfill in Dubai to generate its own energy. The amount of gas recovered by the system will be enough to power a 12 MW engine.

The project has received credits for 300,000 tonnes of greenhouse gas avoided through the Clean Development Mechanism and is the first in the country to be fully registered under the scheme. In terms of emission reductions, the project is the equivalent of removing 60,000 cars off the road.

In February 2014, Green Energy Solutions & Sustainability has also been invited by Dubai Municipality to test the potential for collecting landfill gas from the Jebel Ali landfill, which is no longer in use. In April, the Al Qusais landfill project was awarded top prize in the environment category of the Ideas Arabia International Conference. Dubai Municipality has pledged to generate 20MW of power from landfill gas by 2020. ■

THE WAY FORWARD FOR RENEWABLES

ARTICLE

By Tanzeed Alam



THE NEED FOR A POLICY FRAMEWORK AND WHERE THE UAE MIGHT LOOK FOR INSPIRATION

> The (...) establishment of IRENA, Shams 1 and Dubai's renewable energy target of 5 per cent by 2030 showed the country's growing commitments

It was a proud day for EWS-WWF when the UAE, in front of many high level dignitaries from around the world, announced its first ever renewable energy target in January 2009 at the second World Future Energy Summit. Abu Dhabi's commitment to generate 7 per cent of its energy from renewable sources by 2020 set down an important marker that challenged the world into thinking about why an oil rich country would want to develop renewable energy. The UAE made a rational case. Renewable energy helps to diversify energy production. It redirects capital from oil into new sources of energy, helping to create new economic sectors and jobs and to diversify its economy. It also helps the UAE to mitigate its own growing carbon footprint and contribute to global efforts to tackle climate change.

The subsequent establishment of IRENA, Shams 1 and Dubai's renewable energy target (5 per cent by 2030), were also proud moments for EWS-WWF and showed the country's growing commitment. Dubai in particular, through its integrated energy strategy, is designing a regulatory and policy framework to support the development of renewable energy and energy efficiency. UAE leadership on renewables has also catalysed competition amongst Gulf States to develop more renewable energy. We have been excited by the developments in the wider GCC region, where every country has now set renewable energy targets, with the largest economy, Saudi Arabia, committing to generate almost 40 per cent (or 54GW) of its energy from renewable energy by 2032. Most of these targets will be met through solar power of various forms, reflecting the vast amount of solar potential in the region and the fact that the daily peak for energy demand coincides with peak solar insolation levels.

However, we are concerned that the current projects in the pipeline are not sufficient for the country to achieve its renewable energy targets by 2020, and also whether utility scale renewable energy should be the main response. In order for the UAE to maintain its regional leadership position on renewable energy and to achieve its target, it will require the development of a systematic and comprehensive policy framework for renewable energy, within a broader federal energy policy. We welcome the recent announcements by HE Suhail Al Mazrouei, the Minister of Energy, to develop such a federal energy policy and look forward to contributing to its development. In such a framework, we wish to see:

1. Increased targets for renewable energy to 2030 and 2050, with detailed support schemes such as feed in tariffs or portfolio standards;
2. Provisions for pricing renewable energy so it competes on a level playing field with fossil fuels;
3. Public and private financing mechanisms;
4. Measures to increase cross-emirate and regional collaboration on smart grid development;
5. A governance scheme outlining roles and responsibilities of institutions;
6. Measures to increase investment in renewable energy knowledge, capacity building and R&D.

The benefits of developing a policy framework for renewable energy are clear and evidence is now available from emerging economies of the impact of such frameworks. China for example has a renewable energy law, and its Golden Sun programme provides financial subsidies, technology support and market incentives for the solar industry. From 2008-12, China topped the world in clean energy investments[1] and its six biggest solar companies have a combined market value of over US$15 billion[2]. In Mexico, which is also richly endowed with oil, the development of renewable energy is being driven by its 2012 climate law, which requires a 30 per cent reduction of greenhouse gas emissions by 2020 and 50 per cent by 2050 against Business As Usual (BAU) projections. By 2024, 35 per cent of Mexico's demand for energy needs to be met by renewable energy, and the climate law outlines specific mechanisms, such as the creation of a fund to help facilitate the transition to renewable energy[3]. South Africa's national climate change policy, with targets of 34 per cent reduction of greenhouse gases by 2020 and 42 per cent by 2050 below BAU, also helped to catalyse investment and rapid growth in renewable energy. The participatory process used to develop these policies and increase investment led to an increase in wind generation capacity from 10MW in 2009 to 1300MW by the end of 2013[4].

So the possibilities and best practices exist for the UAE to demonstrate leadership and design its own best practice renewable energy policy framework. The benefits of doing so for the UAE would be many. On average renewable energy provides 1.9-3.2 more jobs than the fossil fuel sector per million US$ invested. There is huge potential to create much needed skilled jobs for young UAE nationals. The UAE can also continue to diversify its economy by developing this sector and creating new niche technologies (e.g. solar desalination) that would enable it to generate further revenue in the future.
Never before has there been a need for such leadership and action on the global stage. Developing clean and renewable energy will contribute to reducing greenhouse gas emissions and help the world mitigate the impacts of climate change. By developing a robust national energy policy that supports renewable energy sources, the UAE would make a very important contribution to the international climate change negotiations, which are due to finalise a new climate agreement in Paris in 2015. Doing so will mean that the UAE will again be able to set down another important marker to the world and show that an oil rich country can also implement its renewable energy target. ■

FOOTNOTES

[1]http://www.environmentalleader.com/2012/01/17/us-replaces-china-as-top-clean-energy-investor/

[2]http://english.people.com.cn/90001/90780/91344/6496247.html

[3]http://www.academia.edu/5976214/Renewable_energy_research_progress_in_Mexico_A_review

ABOUT TANZEED ALAM



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STRIKING THE GOLDEN BALANCE

ARTICLE

By Richard Slark

SEIZING THE UAE'S SOLAR POWER THROUGH BEST PRACTICE IN PPA'S, TENDERING AND SELECTION OF PARTICIPANTS

Abu Dhabi and Dubai have started developing large-scale renewable energy programs. Abu Dhabi targets 7 per cent of generation by 2020. Dubai will build a 1GW solar-park by 2030 and is launching a roof-top PV program.

When assessing the challenges in successfully introducing renewables, Pöyry typically reviews government programs from technical, political, commercial, regulatory and operational perspectives to capture all interactions and deliver successful solutions.

Given the current renewable energy scale-up in the UAE, it is the right time to review the design of the programs, in particular to identify how to attract the best consortia of local companies, international developers and supporting lenders to the UAE. In this process the UAE can draw on learnings from international markets that are further down the line in renewable deployment.

Characteristics of Successful Renewables Programmes

International precedent shows that successful renewables deployment requires:

- Accessible renewable resources;
- Effective renewables support mechanisms which are:
  - Simple,
  - Enduring,
    Well-funded and
  - Credible.
- Removal of structural barriers constraining deployment.

The key aspects to review are the support mechanisms used to attract the best international consortia. Feed-in tariffs (FiT) usually draw in most consortia. However, once FiTs are set, governments have little control over the total capacity built and thus overall programme cost. FiTs require knowledge of cost structures and their future development which usually sits better with developers. Cost structures may change rapidly, as

> The UAE has chosen to start its large-scale renewable programmes based on [power purchase agreements (PPAs)]

> An example of getting this balance right is the UK offshore wind sector

recently experienced for solar PV, while adjusting FiTs to reflect these changes usually takes time. In Europe, this has triggered more solar PV capacity build than envisaged and governments subsidising developers with higher returns than necessary.
In the UAE's conventional sector, power purchase agreements (PPAs) are used. The UAE has chosen to start its large-scale renewable programmes using the same mechanism. This gives control over choosing the winning projects and the speed of deployment. It also makes use of developer knowledge of cost structures while using competition to prevent overpriced bids. The key success factors for the UAE are therefore to define the right PPAs and implement a tendering process that selects the best consortia.



Two Classes of Participants: Lenders and Developers

One aspect to recognise is that renewables programs need to attract two distinct classes of participants: lenders and developers. These have different focus areas and hurdles to participation. Lenders are risk focussed with a strong view to avoid losing their money. Developers are reward focussed, motivated by revenues and profits their future project pipeline is expected to generate.

Lenders are often looking at only a single project. Developers require a predictable pipeline of multiple projects over the short- to medium-term as they need to spread up-front costs and "hidden" or unforeseen costs of first/early project(s) over their project pipeline. They also need to gain familiarity with the local market and confidence in the tendering process.

In summary, lenders will focus on policy and regulatory risks; developers on program size, continuity and project pipeline predictability. An example of getting this balance right is the UK offshore wind sector. Development licences for a wide range of consortia were tendered by setting out a series of rounds and long term transparent support mechanisms. This has enabled the UK to become world leader in this technology.

Where it all Happens: the PPA

PPAs can serve as a main source of security for both lenders and developers, assuming program continuity is in place. When well-defined, PPAs ensure commercial viability for both. On the other hand PPAs can be a source of risk if terms are not well defined. International PPA design best practices can be applied for both the tender process and the drafting of the PPA, as follows:

Tender process:

1. Setting appropriate incentives to deliver awarded projects and/or requiring all relevant project consents are in place prior to award (e.g. in the UK's early NFFO scheme PPAs were signed with developers who did not have planning consents or meet financing requirements; in the absence of incentives to deliver projects (such as financial penalties) a large number of contracted projects were not realised).
2. Avoiding onerous penalties or termination provisions in the event that project timelines slip (e.g. Danish offshore wind projects tenders consented and connected projects to avoid the above problems, but in the last round placed such onerous requirements and penalties on tenders that only the state owned entity bid).
3. Giving assurance to developers that as ambition increases (i.e. higher targets are set), early projects are 'grandfathered' and not exposed to changes made for later projects, e.g. passing on system cost, etc. (e.g. the Spanish government's retroactive actions on supported renewables projects have undermined investor confidence in all infrastructure projects in Spain).
4. Avoiding onerous additional requirements, e.g. highly specific localization requirements etc., creating hurdles that may drive up IRR requirements for initial projects or exclude certain consortia members or structures.
5. Issuing draft PPAs up-front to create visibility of requirements and rewards and allowing stakeholders to provide feedback which is then implemented.

PPA drafting:

1. Timeline flexibility to take account of delays caused by bureaucratic processes.
2. Avoiding changes to PPAs once signed, or providing a defined set of criteria on which they can be triggered and a transparent process for implementing any changes.
3. Using a reasonable interpretation of force majeure to allow enough flexibility.

Selecting the Winner

A winner should be selected based on stringent criteria guiding the decision towards the most suitable consortium. These include:

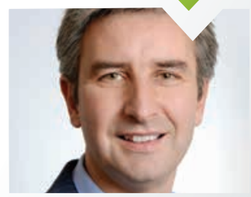
- Transparency – with all selection criteria and applicable weightings set out clearly in the tender documents and explanation of the basis on which any assessments will be undertaken; and
- Accountability – with full disclosure of the award process and any discretion applied.

The UAE's Path to Successful Renewable Deployment

To attract its preferred renewable project types, the UAE will need to define PPAs that attract the right consortia to compete for projects. As international precedent shows, more ambitious programmes with a predictable pipeline and commitment to delivery are more likely to succeed in this. Given its vast solar resource, there is scope for the UAE to increase its relatively modest renewable targets to make the market more attractive but also to reap the benefits associated with more competition and program continuity.

With best practice tendering process and PPA design considerations taken into account, the UAE's renewable energy programs will be a regional and international success. ■

ABOUT RICHARD SLARK



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THE PAN-ARAB RENEWABLE ENERGY ROADMAP FOR 2030

ARTICLE

By Mustapha Taoumi and Ali Alshehhi

> The Pan-Arab Renewable Energy Strategy (...) in January 2013, signalled the first consensus on key goals to improve the region's energy future

STEPS TOWARDS A RESILIENT, LOW-CARBON ECONOMY IN THE ARAB REGION

Many Arab countries have experienced rapid economic growth over the past decade, in combination with a rising population. With these trends expected to continue, the region must prepare for an increase in energy demand in the decades ahead.

The Arab region – covering much of the Middle East and North Africa – encompasses oil-rich economies, as well as those with scarce conventional energy resources. But with domestic power demand expanding at a rate of between 3 per cent and 8 per cent annually across the region, even key energy exporters face the prospect of becoming net energy importers. Moreover, the Arab countries are particularly vulnerable to water scarcity, which is anticipated to worsen as an effect of global climate change.

However, the region also offers geographic and climatic advantages, including the world's greatest technical potential for solar power generation. In addition, Arab countries have good wind speeds for power generation and, in some cases, high potential for waste-to-energy and hydropower development. This array of renewable energy potential could replace the oil or gas currently used for over 94 per cent of the region's power generation. Along with averting a major source of carbon-dioxide emissions and reducing dependence on fossil fuels for basic needs, the transition to renewables in the power sector would make oil and gas surpluses available for more profitable downstream applications and export. The renewable energy supply chain, meanwhile, could drive economic diversification and create new jobs in local economies.

The Pan-Arab Renewable Energy Strategy, adopted by the Arab Economic and Social Development Summit in January 2013, signalled the first consensus on key goals to improve the region's energy future, with countries adopting individual targets for the year 2030. Moving forward, the International Renewable Energy Agency (IRENA) aims to support Arab countries in reaching their agreed levels of deployment. While the targets appear realistic, achieving them will require major policy decisions and infrastructure investments.

States across the region need to improve their institutional frameworks, upgrade existing power grid infrastructure, ensure the availability of finance and build a skilled workforce for accelerated renewable energy deployment. IRENA is therefore closely engaged with its member countries in the Arab region on strategies, readiness assessments, capacity building and resource mapping. The intergovernmental agency, with a mandate to promote the sustainable use of all forms of renewable energy worldwide, is working with the League of Arab States and the Cairo-based Regional Centre for Renewable Energy and Energy Efficiency (RCREEE) to identify priorities for the implementation of the Pan-Arab strategy.



The organisations recently published a report on ways to implement the Pan-Arab strategy for 2030. The study, Pan-Arab Renewable Energy Strategy 2030: Roadmap of Actions for Implementation, identifies gaps and barriers, providing concrete advice on improving investment conditions for renewables, and outlining steps to facilitate knowledge transfer and build local skills.

There are three main challenges in relation to the region achieving its renewable targets:

- Political, legal, regulatory and institutional;
- Financial, market and economic; and
- Technological, infrastructure and human capacity.

The study illustrates key strengths and weaknesses in the Pan-Arab strategy, along with the opportunities and potential threats these entail. For each country to address its gaps and achieve its national targets, the report proposes a roadmap of country-specific actions, consistent with the existing regional framework and national action plans for renewable energy. There is a specific focus on helping countries achieve their nationally endorsed targets in the electricity sector. The regional roadmap also provides broader recommendations based on common challenges and opportunities for all Arab countries, including the development of the Arab renewable energy market.

To improve countries' readiness to scale up the share of renewables in their energy mix, the study recommends focusing regional cooperation for the next few years on several key initiatives:

- Create technical and financial assistance programmes to support Arab states in designing their respective National Renewable Energy Action Plans (NREAPs);
- Develop and fund a comprehensive, holistic capacity-building project covering the entire renewable energy development life cycle, including planning, resource assessment, feasibility studies and implementation;
- Explore untapped renewable energy potential, including heating and cooling, water desalination, biomass, geothermal, small hydro and pumped storage opportunities;
- Launch a power grid integration initiative, "Pan-Arab Clean Energy", to incorporate greater amounts of renewable electricity into the region's power systems;
- Enhance spatial planning and administrative frameworks for renewable energy deployment;
- Create a framework for improving regional financial cooperation and mitigate investment risks for public and private sectors for accelerated renewable energy deployment;
- Conduct regional studies to assess local manufacturing and future integration plans.

Successful implementation will depend on coordination among all organisations involved in promoting renewable energy around the region, with clear mechanisms to avoid duplication of efforts. IRENA, the Arab League and RCREEE will establish a regional working group to ensure effective follow-up on the strategy.

The timely implementation of the Pan-Arab strategy will ensure that that deployment of renewable energy continues to accelerate, with the potential to almost double by 2030. IRENA's global roadmap, REmap 2030, shows that even more could be achieved with the adoption of further pro-renewable plans and policies. Starting with the measures envisioned in the regional roadmap, Arab countries could play a significant role in the global renewable energy market, which will be the cornerstone of the low-carbon green economy of the future. ■

The Regional Center for Renewable Energy and Energy Efficiency (RCREEE) is an independent not-for-profit regional organisation which aims to enable and increase the adoption of renewable energy and energy efficiency practices in the Arab region. Through its solid alliance with the League of Arab States, RCREEE is committed to tackle each country's specific needs and objectives. In 2014, RCREEE has fourteen Arab countries among its members and is financed through its member state contributions and foreign government grants. → http://www.rcreee.org

→Find out more
Pan-Arab Renewable Energy Strategy 2030: Roadmap of Actions for Implementation was published by IRENA and the League of Arab States in cooperation with RCREEE in June 2014.
→ http://irena.org/Publications/index.u=cat&PriMenuID= 36& CatID=141

ABOUT MUSTAPHA TAOUMI AND ALI ALSHEHHI





IRENA Country Support and Partnerships

SHAMS 1 CONCENTRATED SOLAR POWER PLANT: PROJECT OVERVIEW



In March 2013, Abu Dhabi's future energy company, Masdar, inaugurated the largest solar power plant built in the Middle East. With a capacity of 100 megawatts (MW) – enough to power 20,000 homes – Shams 1 is one of the world's largest concentrated solar power (CSP) plants. It stands as an engineering feat and makes a significant contribution in helping the UAE meet its ambitious energy diversification goals.

The Shams 1 power plant cost US $600 million to build over three years and Masdar owns a 60 per cent stake in the project with the remaining 40 per cent shared by Total and Spain's Abengoa Solar. The latter is the world's largest developer of CSP and owns almost three quarters of global capacity. Shams 1 covers an area of 2.5 square kilometres – the equivalent of 285 football fields – and incorporates the latest in parabolic trough technology.

The power plant displaces approximately 175,000 tonnes of carbon dioxide annually. This is equivalent to planting 1.5 million trees, or removing 15,000 cars from the roads.

The sun's energy is harvested across Shams 1 through 258,000 mirrors mounted on 768 tracking parabolic trough collectors. These work to capture sunlight and concentrate it to heat synthetic oil, which is then used to produce steam.

This steam in turn drives an electricity turbine to generate power. Besides the energy it generates from the sun, Shams 1 also relies on a small amount of natural gas to boost the temperature of the steam as it enters the turbine. This has served to dramatically increase the turbine's overall efficiency.

The plant is situated in the town of Madinat Zayed, 120 kilometres from Abu Dhabi city, in the Western Region. Situated on the edge of the Rub' al Khali (the Empty Quarter), the engineering team had to apply a number of solutions to ensure the plant's resilience in the hot and arid desert climate. In an effort to reduce water use, the plant features a dry-cooling system for the electricity turbines. Improving water efficiency is a priority for the UAE given the scarcity of fresh water resources in the country, and the associated energy and carbon costs of desalination. Another locally-specific feature of Shams 1 deals with the strong desert winds which bring with them lots of sand particles. Grains of sand settling on the energy-concentrating mirrors significantly reduce the mirrors' ability to collect and concentrate sunlight, thus diminishing the plant's overall operating efficiency. A seven metre high wall and wind break was therefore built around the entire Shams 1 complex, in order to help mitigate the impact of the sand particles.

The Shams 1 project is not only the first large-scale renewable energy project in the UAE, but is also a major step towards diversifying the country's energy mix. Clean energy investments such as these are also building knowledge capital domestically. The experience derived from building the plant has effectively helped boost Masdar's expertise and ability to deliver other CSP plant projects both in the UAE and abroad. The construction phase has also offered attractive economic benefits to local businesses which were able to contribute during the design and construction phases of the project.

Besides the benefits to the local economy, Shams 1 has also put the UAE on the global renewable energy map. Following the plant's successful launch in 2013, the country now ranks third in the world in terms of installed CSP capacity, according to a report by REN21 (Renewable Policy Network for the 21st Century). The UAE is third only to Spain (with 2,300 MW of CSP) and the United States (with 882 MW), in terms of capacity. With global CSP capacity rising by 36 per cent in 2013 alone, Masdar's decision to invest in the technology at such a scale is a timely decision – one which looks to help Abu Dhabi secure economic, social, and environmental benefits for years to come. ■





100 MW
enough to power 20,000 homes



The Shams 1 power plant cost
US $600 million



Shams 1 covers an area of 2.5 square kilometres =
285 football fields

SETTING A PLACE FOR THE SUN

ARTICLE

By Tabaré A. Currás



"We must not rely on oil alone as the main source of our national income. We have to diversify the sources of our revenue and construct economic projects that will ensure a free, stable and dignified life for the people." The late HH Sheikh Zayed bin Sultan Al Nahyan (may his soul rest in peace)

Forty years ago, His Highness Sheikh Zayed bin Sultan Al Nahyan had a vision of a country where all citizens would receive high quality welfare, education, health and housing. Today, after decades of commitment to increase the living standards of its people, the United Arab Emirates (UAE) economy and social services rank among the advanced in the world[1]. The country has made the vision a reality.

The UAE is a great example of what a country can achieve with determination and vision. Being richly endowed in oil and gas resources has helped the country to grow its economy and develop rapidly. The UAE succeeded in creating wealth among its citizens through the exploitation of fossil fuels.

While this model has worked well, it is not sustainable in the long term. The stagnation of the UAE's proved oil and gas reserves[2] and the long term impacts of climate change to the Arab region[3] encourage the country to embrace alternative sources of energy. In the 21st century, the economy of UAE will be defined not by its oil and gas production capacities, but by global market and geopolitical trends and the increasing search for energy security and independence[4].

> With a solar insolation that exceeds 8.5 GJ/m2, the opportunities are vast

Beyond oil and gas, the UAE is also extremely well endowed with sunlight. With solar isolation that exceeds 8.5 GJ/m2, the opportunities are vast[5]. Technologies such as solar water heating, photovoltaic (PV) and concentrated solar power (CSP) can meet the country's demand for energy while maintaining a path towards further industrialization and socio-economic development. CSP alone has the potential to provide about 20 times the UAE's current electricity needs[6 7].

Today there is a new opportunity for the UAE to shape its future using new energy sources for its people. The endeavour has started. The cities of Abu Dhabi and Dubai have taken their first steps by adopting renewable energy targets of 7 per cent and 5 per cent by 2020 and 2030 respectively; but the UAE can go further.

> Abu Dhabi's 100 MW Shams plant, the largest solar project on Earth, has operated 11,000,000 man-hours without major incident

Despite its vast solar resources, the UAE still generates over 80 per cent of its power from natural gas, and since 2007 has become a net importer[8]. Furthermore, given that electricity demand in the country has increased by approximately 11 per cent per annum over recent years, pursuing solar power will soon become a matter of necessity[9].

While the UAE is still in the early stages of implementing solar (combined solar power installed capacity including PV, CSP and heating/cooling remained less than 140 MW in 2013[10]), it is worth noting that in some countries such as the United States, Germany, Spain, China, Italy, Turkey and Chile (among others), solar power is no longer a futuristic dream but a tangible reality[11].

As prices for PV solar power have dropped steadily, related technologies have become increasingly competitive[12]. In many markets, PV is at (or approaching) parity with grid electricity and is therefore substituting or replacing conventional generation. Moreover, in countries with similar or lower insolation levels to the UAE, PV power is already at wholesale parity (e.g. in Japan) or at retail parity (e.g. in Australia, Germany, Italy and Spain). As a result, investors have gained confidence in solar power and started seizing the real business opportunity of a transition to PV, worth at least US$ 1 trillion worldwide[13].

CSP can provide reliable and flexible clean electricity to meet power demand; The UAE already is leading by example; Abu Dhabi's 100 MW Shams plant, the largest solar project on Earth, has operated 11,000,000 man-hours without major incident[14]. Under favourable conditions (e.g. resource availability and policy support), CSP is already competitive with power generation from fuel oil and nuclear power[15 16]. Moreover, it is expected that the cost of future CSP plants will break even with natural gas by 2020[17].



For the UAE, solar power is an attractive option at both centralized and distributed levels. Integrated into new construction, onto existing rooftops, as a cooling/heating technology in the residential and industrial sectors or as an alternative to diesel generators, solar power can offer energy security potential for the UAE.

Transforming the UAE's power system in order to take advantage of its solar resources will require more action. In the UAE, the cost of electricity from solar power is higher than that of gas on a levelised cost of electricity (LCOE) basis[18]. However, solar power can become more competitive with an increased level of ambition on solar energy targets, wider regulatory frameworks that include market drivers and incentives (e.g. feed-in-tariffs), improved financial conditions for decentralized power development (e.g. removing subsidies on electricity rates) and capital access provisioning for up-scaling solar projects[19].

> HH Sheikh Zayed Bin Sultan Al Nahyan (may his soul rest in peace) was right when he affirmed that the real treasure of any nation is its people

HH Sheikh Zayed Bin Sultan Al Nahyan (may his soul rest in peace) was right when he affirmed that the real treasure of any nation is its people. To make solar power the new norm for the UAE, knowledge and human capital must be invested in the solar sector. Solar power should not be seen only as a source of sustainable energy, but also as a central component of industrial development. It is a sector that can deliver high quality jobs (there are over 2.8 million solar jobs worldwide[20]) and provide opportunities for technology research and development to support the transition to an advanced knowledge economy. Nothing is more powerful than a vision to create a sustainable future. It is the people who can bring such a vision into reality. With the right level of support for solar power, the UAE can seize the potential to diversify its economy, continue to grow and ensure its future is bright. ■

ABOUT TABARÉ A. CURRÁS



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FOOTNOTES

1Ministry of Economy - United Arb Emirates, Millennium Development Goals - United Arab Emirates Report (Abu Dhabi, March 2007). 2BP Statistical Review of World Energy 2014 (London: BP, June 2014). 3M.K. Tolba and N.W. Saab, Arab Environment Climate Change - Impact of Climate Change on Arab Countries (Lebanon: Arab Forum for Environment and Development (AFED), 2009), p. 159. 4OECD/ IEA, World Energy Outlook 2013 (Paris, 2013). 5A Kazim, 'Strategy for a Sustainable Development in the UAE through Hydrogen Energy', Renewable Energy, 35 (2010), 2257–69. 6DLR, Concentrating Solar Power for the Mediterranean Region (Stuttgart: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, 16 April 2005). 7BP Statistical Review of World Energy 2014. 8A Mokri, M Aal Ali and M Emziane, 'Solar Energy in the United Arab Emirates: A Review', Renewable and Sustainable Energy Reviews, 28 (2013), 340–75. 9Mokri, Aal Ali and Emziane. 10REN21, 'Renewables Interactive Map', Country Profile: United Arab Emirates, 2014 <http://bit.ly/1nqDg4d> [accessed 14 July 2014]. 11REN21, Renewables 2014- Global Status Report (Paris, 2014). 12The Pew Charitable Trust, 2013 Who's Winning the Clean Energy Race? (Washington DC, 2014) <pewtrusts.org/cleanenergy>. 13Citi Research, Citi Climate Change Universe: The $5.7 Trn Renewables Opportunity That Still Remains (Citi, 19 September 2013), p. 64. 14Achievments', Shams Solar Power Project, 2014 <http://bit.ly/1tRTsoD> [accessed 16 July 2014]. 15IRENA Secretariat, Renewable Power Generation Costs in 2012: An Overview (Abu Dhabi: IRENA, 2013). 16B Sovacool, 'Exploring the Hypothetical Limits to a Nuclear and Renewable Electricity Future', International Journal Energy Research, 34 (2010), 1183–94. 17F Trieb, T Fichter and M Moser, 'Concentrating Solar Power in a Sustainable Future Electricity Mix', Sustain. Sci, 9 (2014), 47–60. 18LCOE analysis do not take into consideration other costs except for up-front costs, variable costs (such as for fuel, operations and maintenance), and costs of capital over the lifetime of the project; that is, environmental externalities, decommissioning costs, or any pre-tax or post-tax subsidies and tax credits are excluded by the LCOEs. 19PwC, Switch on the Lights - Unlocking the UAE's Solar Potential (UAE: ESIA, January 2012). 20REN21, Renewables 2014- Global Status Report, Paris

SOLAR COOLING FOR SHEIKH ZAYED DESERT LEARNING CENTRE

SEIZING UAE'S SOLAR POWER

FACT BOX

Sheikh Zayed Desert Learning Centre (SZDLC) is a building complex incorporating a variety of advanced energy technologies, significantly reducing its carbon footprint. The building has been designed according to LEED Platinum criteria, to reduce life cycle costs and environmental impact, and is a flagship sustainable building in the UAE, ratified by the ESTIDAMA 5 pearls rating for its sustainable design.



Solar cooling is using heat produced in solar thermal collectors as driving energy for the cooling process. Such technology has been in industrial usage for more than 100 years and is well established today. SZDLC uses 1,134m² of special double-glazed flat plate collectors for driving a 100-tonne lithium-bromide chiller. The cooling energy produced chills the concrete walls and ceilings which have an integrated piping system for concrete core activation.

The system was commissioned in 2012 and has operated as projected since. According to the physical nature of the system, the solar installation delivers most during the sunniest hours of the day, reducing consumption from the electricity grid during these peak hours.

Solar thermal installations perform well in hot desert climates as thermal collectors become more efficient the hotter the ambient environment is. This is contrary to photovoltaic systems, which suffer efficiency constraints in hot operating conditions. ■

EVOLUTION OF THE UAE ENERGY-WATER NEXUS

ARTICLE

Dr. Steven Griffiths

> At present seawater desalination capacity in the GCC represents approximately half of the worldwide seawater desalination capacity



NEW OPTIONS ARE ON THE HORIZON FOR EFFICIENT AND LOW-CARBON CLEAN WATER PRODUCTION IN THE UAE

The Middle East and North Africa (MENA) region contains approximately 66 per cent of the world's proven crude oil reserves but only about 1.4 per cent of the world's fresh water supply. Therefore, MENA countries, particularly the Gulf Cooperation Council (GCC) countries, are subject to water scarcity, a condition where renewable water resources are less than 1,000 m3/year/capita. Seawater desalination is a critical means of meeting the GCC's increasing demand for water. At present seawater desalination capacity in the GCC represents approximately half of the global seawater desalination capacity with the GCC countries of Saudi Arabia and the United Arab Emirates (UAE) serving as the global leaders in commissioned capacity. In 2013, the UAE's commissioned seawater desalination capacity stood at 8.38 million m3/day and this capacity is set to increase in the coming years as the UAE's demand for clean water continues to grow.[1]

More than 80 per cent of the desalination capacity in the GCC is based on thermal technologies[2], particularly multi-stage flash (MSF) and multi-effect distillation (MED), which are driven primarily by thermal energy from the combustion of fossil fuels. In the UAE, seawater desalination is dominated by MSF technology that is part of gas-fired cogeneration power plants that produce electricity and water together. This coupling of power and water generation is

problematic in light of the country's increasingly scarce supply of cheap natural gas, as well as the inefficiencies of cogeneration that result from the relatively constant seasonal water demand, but highly fluctuating seasonal power demand.

Based on these factors, as well as concerns for air quality and climate, there is an increasing desire to move away from thermal seawater desalination that is coupled either directly or indirectly to fossil power production. Alternatives include thermal desalination using renewable energy sources, such as concentrating solar and geothermal, and electricity driven membrane desalination, which is the use of semipermeable membranes and pressure to separate salts from water, powered by clean energy.

Solar energy is the most abundant clean energy source in the Gulf. Abu Dhabi has already commissioned the 100MW Shams 1 concentrated solar plant (CSP) in western Abu Dhabi, which was formally opened in March 2013. A 10MW PV power plant was inaugurated at Masdar City in June 2009 and Abu Dhabi is home to one of the most extensive solar rooftop networks in the region. Masdar's second large-scale solar project, a 100MV solar PV plant known as Nour 1, is awaiting final government approvals. It is noteworthy that the Environment Agency Abu Dhabi (EAD) has already initiated solar desalination, although at small scale, via 30 reverse osmosis desalination units in remote areas powered by PV technology. Each unit produces 5 m3/hour of desalinated water suitable for livestock and irrigation purposes. The first notable solar projects in Dubai are already coming online following the October 2013 launch of the 13MW PV plant at the Sheikh Mohammad Bin Rashid Solar Park. The park will ultimately achieve



1,000MW of solar capacity by 2030 and is intended to be complimented by a Dubai solar rooftop program.

Among the UAE organizations involved in renewable energy, Masdar is the most notable. All of the renewable energy projects currently under way in Abu Dhabi come under the umbrella of Masdar as do an increasing number of major renewable energy projects regionally and globally. Furthermore, Masdar City has become a model for efficient, sustainable urban development and Masdar Capital has two investment funds that take stakes in international companies that are developing clean energy technology.

> "In 2013, the UAE's commissioned seawater desalination capacity stood at 8.38 million m3/day"

Recognizing that efficient, clean water production is a major component of sustainability, Masdar launched a pilot program in January 2013 to test and develop advanced, energy-efficient seawater desalination technologies suitable to be powered by renewable energy sources. Several objectives were outlined for the program to ensure that it would have a maximum impact on the future of desalination:

1. Development and demonstration of seawater desalination technologies that (1) are more energy-efficient than current state-of-the-art systems, (2) can be powered by 100 per cent renewable energy sources, (3) have minimal environmental impact and (4) are reliable, robust, bankable, and suitable for UAE seawater and environmental conditions;
2. Development and demonstration of state-of-the-art seawater desalination technologies and innovative seawater desalination technologies that greatly exceed the state-of-the-art;
3. Development in the short to medium term of a renewable energy powered seawater desalination plant that is cost-competitive with non-renewable energy powered seawater desalination; and
4. Scaleup of piloted seawater desalination technologies into industrial scale renewable energy powered seawater desalination plants in the UAE by 2020.

In February 2014 Masdar issued a request for qualifications from bidders, with the intent of sharing the piloting costs. Bidders were required to demonstrate that their technologies could exceed the state-of-the-art in energy consumption for desalination of Gulf seawater, which has a high total dissolved solids (TDS) concentration of 45 to 50 parts per thousand (ppt) and a temperature that reaches more than 35 degrees Celsius in the summer.. Specifically, membrane and thermal desalination technologies to be optimized as part of the program had to be shown to have the potential to lower desalination energy consumption by at least 15% relative to the best available technologies currently in use. Even more stringent energy consumption requirements were established for novel technologies yet to be commercially deployed. Any thermal energy required for desalination was specified to come from only renewable sources, such as geothermal or solar power, rather than waste heat from external industrial sources. In addition, all of the desalinated water produced must meet the high-water quality standards set by the Abu Dhabi Regulation and Supervision Bureau (RSB).

Masdar coordinated a selection of the bidders with key Abu Dhabi stakeholders, including the Abu Dhabi Water & Electricity Authority (ADWEA), the Abu Dhabi Sewerage Services Company (ADSSC), RSB and EAD. In May 2014, Masdar announced that four international water technology companies had been selected for the pilot project: Abengoa (Spain), Degremont (France), Sidem (France) and Trevi Systems (USA). The technologies that these companies will pilot are all membrane technologies, specifically reverse osmosis and, in the case of Trevi Systems, forward osmosis. In addition to water pretreatment and post-treatment required for membrane operations, treatment of concentrated brine via membrane distillation and ion exchange technologies will be assessed. During the course of the 18 month piloting phase in the Ghantoot test facility, the test plants will provide 1,500 m3 of potable water per day to Abu Dhabi's water infrastructure.

It is clear that electricity-driven membrane technologies will play a key role in meeting the UAE's future seawater desalination needs. A decoupled power and water system provides the UAE with strategic flexibility to potentially increase its targets for solar power adoption as the costs of solar power, particularly solar PV, continue to fall and large-scale energy storage options continue to expand beyond those that are commercially viable today. The UAE has historically been a regional leader in energy and sustainability and so evolution of the country's energy system toward one that incorporates an increasing share of clean and renewable energy with compatible seawater desalination capacity is to be expected. The Masdar Renewable Energy Seawater Desalination Program is one more step in the right direction. ■

> "This coupling of power and water generation is problematic in light of the country's increasingly scarce supply of cheap natural gas"

MESIA Middle East Solar Industry Association

Masdar

Masdar Institute of Science and Technology (Masdar Institute) is the world's first graduate-level university dedicated to providing real-world solutions to issues of sustainability, created in collaboration with the Massachusetts Institute of Technology (MIT). It aims to support Abu Dhabi's economic diversification by nurturing highly-skilled human and intellectual capital and partnering with industry leaders. It seeks to be a leading renewable energy and clean technology player by providing a test bed for the world to develop commercially viable and sustainable energy solutions, amongst them renewable desalination technology.
--> https://www.masdar.ac.ae
The Middle East Solar Industry Association (MESIA) is a non-profit, non-governmental organization. Its mission is to expand the use of solar power in the Middle East, to strengthen the local solar industry, and to facilitate business opportunities for its members. MESIA was born when a group of solar pioneers came together and in 2009 found support by their institutional founding members, amongst them Masdar Institute
--> http://www.mesia.com

ABOUT DR. STEVEN GRIFFITHS



He is the Executive Director of Institute Initiatives and Professor of Practice at the Masdar Institute of Science and Technology. He leads the Institute's research activities, and also is a member of the Board of Directors of the Middle East Solar Industry Association (MESIA).

SPARKING INNOVATION AROUND THE WORLD

ARTICLE

> We will be looking to attract companies that work in the gasification of biomass

> A 10-minute drive from the Beatles Museum is TAQA's Gas Storage Bergermeer plant, one of the largest in north-west Europe

HOW THE ABU DHABI NATIONAL ENERGY COMPANY'S 'ENERGY INNOVATION PARK' SETS R&D IMPULSES IN THE DUTCH COUNTRYSIDE

Alkmaar in the Netherlands is renowned for its historic buildings and spectacular tulip fields. Now, a new attraction is taking shape on the outskirts: a 21st-century Energy Innovation Park alongside one of north-west Europe's largest gas storage plants.

The city of Alkmaar in the Netherlands merges the past with the future. Behind the historic façade and the bustle of the 400-year-old cheese market nestles an unusual tribute to a bygone era. Tucked away on Kanaalkade 21A is the Beatles Museum.

Memorabilia adorns the walls in a magical mystery tour of nostalgia. Missing from the plethora of posters and vinyl records, however, is John Lennon's first guitar – a sad omission because it was one of the reasons why the museum was built in the first place.

Puzzled? Well, according to pop folklore, the guitar was made in Alkmaar. But then the city is full of surprises. Just a 10-minute drive from the Beatles Museum is TAQA's Gas Storage Bergermeer plant, one of the largest in north-west Europe. An Energy Innovation Park (www.energypark.nl) is poised to spring up around the site within the next 10 years – an R&D energy centre just a heartbeat away from the city. "We hope that this park will be a flagship of technological excellence in clean energy and gas projects," says Bas Froon, Manager of Land Development at TAQA's Dutch operation. "Obviously, this is a long-term project for the next 10 years. This will also help us generate more long-term employment in our business."



As Europe and the rest of world grapple with a surge in energy demand, finding new cleaner energy sources and the technology to store the power they produce has become paramount. Research into biomass, power to gas and turning plastics into oil are prospective projects.

Advanced Technology

Hopefully, further research and development will take place at the Energy Innovation Park in the next few years. "We will be looking to attract companies that work in the gasification of biomass," says Mr Froon. "That is an area that we are very interested in, as well as power to gas. The wind-power industry in Europe is already looking at storing excess electricity when more wind farms come online in the next five or 10 years. This involves turning that electricity into natural gas, which is easier to store."

Using advanced technology to make that happen is distinctly possible. There has already been a "dramatic growth" in the wind-power sector since the turn of the 21st-century, according to the IEA's Technology Roadmap: Wind energy report (2013 edition). → http://www.iea.org/publications/freepublications/publication/Wind_2013_Roadmap.pdf

By 2050, wind power could generate up to 18 per cent of the world's electricity, compared with 2.6 per cent in 2013. According to the IEA report: "The nearly 300 gigawatts of current wind power worldwide must increase eight- to 10-fold to achieve the roadmap's vision, with the more than US$78bn in investment in 2012 progressively reaching US$150bn per year."

Human investment will be central to the Energy Innovation Park, with a hot-house environment enticing companies working on the cutting edge of energy technology. The decision to push ahead with the project was taken at the end of 2013.

"It's our own initiative that was started a couple of years ago during the development of the Gas Storage Bergermeer project," says Mr Froon. "The whole idea was about how we could utilise our presence there along with other stakeholders, such as the local and regional governments, by attracting other energy businesses to the region. We are one of the driving forces in promoting the park. This will involve using the area around the gas storage plant by selling or leasing plots of land to other innovative energy companies to build research and development centres."

The project could be as large as 420,000 sq m – the size of a small village. But this will depend on the "market". "At the moment, we have 12 big plots," says Mr Froon. "But we are already splitting them up into smaller locations for companies that would need more compact facilities. Since this is a long-term project, it will be built in stages."

Signed Up

One company that has signed up is Technobis. The Dutch firm specialises in measuring equipment, optics, photonics and sensor technology. Since it was founded in 2006, Technobis has become a "technology doctor" for clients. The company is also "participating in promising start-ups" and developing new equipment.

> The project could be as large as 420,000 sq m – the size of a small village

"Technobis will move in later this year. They plan to do research and development in measuring devices and fibre-optics," says Mr Froon. "In the years ahead, we hope that the park will explore new technologies that will help the energy industry. It will take time, but the groundwork is in place."

Back in the Beatles Museum in Alkmaar, a cover sleeve of Let It Be hangs on a crowded wall. One of the tracks on the 1970 album was 'The Long and Winding Road', which is rather apt. To paraphrase Lennon and McCartney, it is a "long and winding road" that might just lead to TAQA's door. ■

DID YOU KNOW?

TAQA means energy in Arabic. TAQA Global is an international energy and water company listed in Abu Dhabi and operating in 11 countries across four continents. With a gross power generation capacity of 16,395 MW and a water desalination capacity of 887 MIGD, it is the largest independent power producer in the Middle East and North Africa (MENA) and the largest owner of power generation and water desalination assets in the United Arab Emirates in 2013. www.taqaglobal.com

03

FUEL & INFRA-STRUCTURE

HIS EXCELLENCY
ENG. ABDULLA NASSER AL SUWAIDI

DIRECTOR GENERAL OF THE ABU DHABI NATIONAL OIL COMPANY (ADNOC)



Since its establishment in 1971, Abu Dhabi National Oil Company (ADNOC) has contributed to the growth of the United Arab Emirates by overseeing Abu Dhabi's Oil and Gas sector and ensuring best practices are followed in the Technical, Health, Safety, Environment and Human Capital Development fields.

In line with sustainable development priorities set by Abu Dhabi Vision 2030, ADNOC is committed to implement the best approaches and practices for boosting energy efficiency, minimising environmental impact and developing infrastructure utilising the wealth and diversity of our operations and experience.

Our initiatives span Abu Dhabi's entire oil and gas value chain with a number of projects and initiatives launched by our group of companies aiming at energy efficiency and value optimisation. The clean technologies such as carbon dioxide (CO_2) injection into oil fields are being used to enhance oil recovery (EOR), and sour gas fields development projects are underway to build up the sour gas production capacity. These ambitious projects aim to meet both domestic and global oil and gas demands. In addition, they help limit emissions and reduce carbon footprints. Moreover, ADNOC has opened compressed natural gas (CNG) filling stations and vehicle conversion centres to facilitate the growth of natural gas vehicle (NGV) adoption across the UAE and has introduced solar panels to supply energy for remote platforms.

ADNOC keeps green initiatives and environment protection at the top of its agenda and will continue to provide the utmost support to the UAE's sustainable development by contributing to its society, welfare and education, promoting energy efficiency and ensuring a sustainable fuel supplies.

ADNOC is fully aware that building and maximising in-country value is an essential element in the quest towards economic sustainability and diversification.

As the national oil company of Abu Dhabi and a key contributor to UAE socioeconomic development, ADNOC is integral to driving the creation of in-country value through the transfer of knowledge and technology, investment in research and education, and establishment of best practices across the industry. Within the context of efforts to develop the energy sector, ADNOC has recognised the need to develop a national workforce with the right skills set for the oil industry.

The goal of ADNOC's Emiratisation strategy was always to equip a growing number of Emiratis with the technical capabilities needed inside the company. To this end, ADNOC got involved with Abu Dhabi's Petroleum Institute, which develops high-quality engineering and science professionals—including since 2006, females—and established the ADNOC Technical Institute (ATI), a vocational training institute that trains UAE nationals as technicians. Technical Career Progression programmes, aimed at grooming and retaining internal technical specialists and experts, have been introduced.

These initiatives were complemented by the ADNOC Scholarship program which offers talented high-school graduates the opportunity to pursue their university studies in leading academic institutions in the UAE and abroad.

We, at Abu Dhabi National Oil Company (ADNOC), recognize the importance of the UAE State of Energy report and accordingly pledge our full support to this initiative and look forward to sharing ADNOC sustainable development practices and case studies.

THE UAE OIL AND GAS INDUSTRY: FUELING THE NATION



MAIN REPORT

By Dr. Saif Sultan Al Nasseri

The United Arab Emirates is blessed with a wealth of hydrocarbon resources making it one of the 10 largest oil and gas producers globally. These resources have helped advance the country's economic and social development in recent decades, turning the country into a global financial and trade hub. Alongside the development of these natural resources has come a government focus on widening the UAE energy mix through the introduction of renewable and nuclear energy.

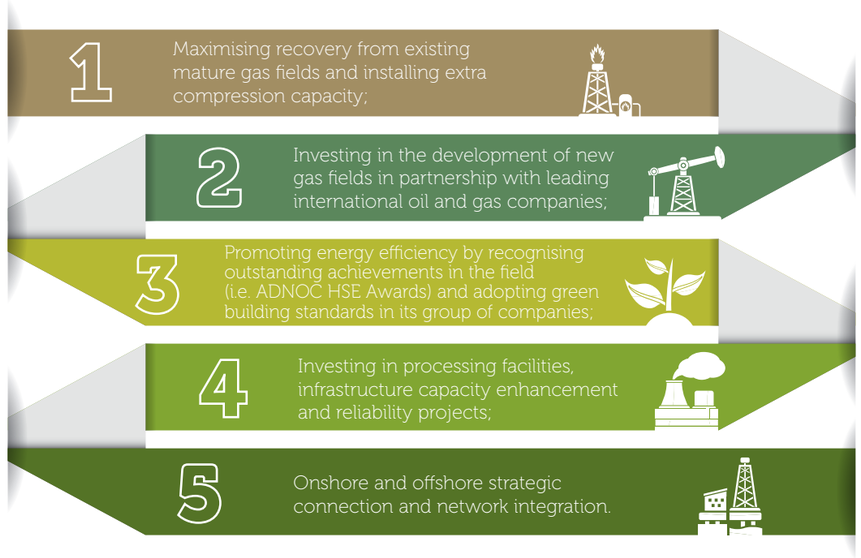
The UAE oil and gas sector has helped meet the country's energy needs and has supported growth through enabling electricity and water production. The sector's role also extends to transportation, value creation and corporate citizenship.

The oil and gas industry has developed robust production, processing, storage and distribution infrastructure spanning the entire UAE from Abu Dhabi to Fujairah.

Abu Dhabi National Oil Company (ADNOC) manages Abu Dhabi's oil and gas industry value chain from upstream operations to distribution, including logistical support services and educational assets. With strong infrastructure and leading industry know-how, ADNOC is also a key participant in the overall UAE oil and gas industry, including in infrastructure development and value-realization.

The development of the oil sector is at the top of the agenda for key UAE stakeholders such as the Supreme Petroleum Council (SPC) and ADNOC. To achieve this aim, several initiatives have been launched to optimize and develop the existing oil reserves output through utilising the latest research and technologies such as Enhanced Oil Recovery (EOR). Such development is not restricted to existing fields already in production, but also extends to the exploration of new more challenging fields.

The natural gas sector is an important driver of economic development as its output is used by the manufacturing, power generation and petrochemical industries. The sector is under increasing pressure to meet the needs of the UAE population and support economic growth, with ADNOC investing in a range of initiatives to maximise the contribution of natural gas to the energy mix. These include:



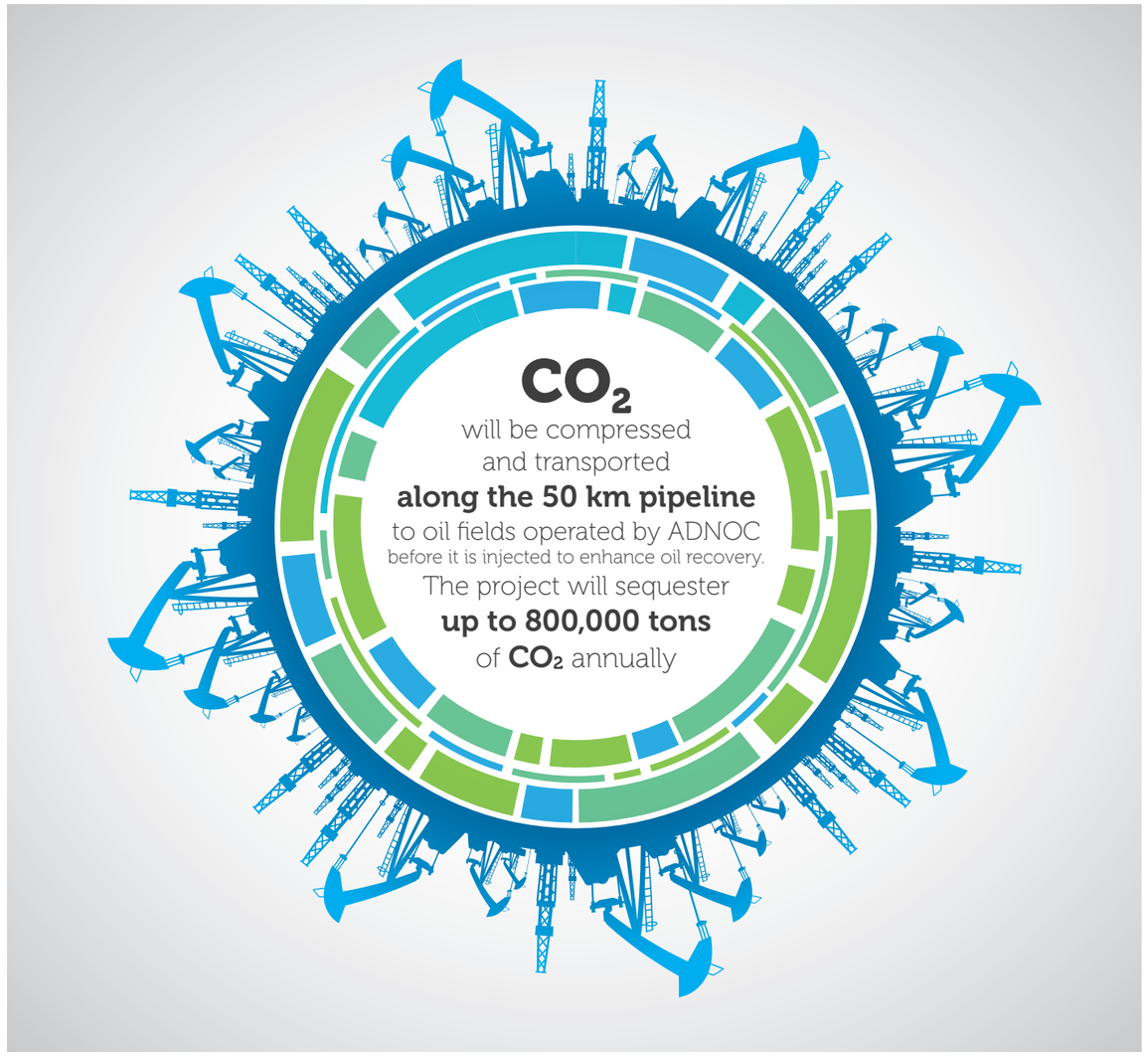
The country places an emphasis on developing this sector in a way that honours its commitment to sustainable development and reduced environmental impact. Current projects include the commissioning of new gas production facilities in Abu Dhabi, and the exploitation of sour gas fields. Sector development also extends to collaboration and integration with other countries within the Gulf Cooperation Council, through networks of gas pipelines, trains, and power systems.

ADNOC: A Pillar for UAE Oil and Gas Industry

Abu Dhabi National Oil Company (ADNOC) leads the Emirate Oil and Gas industry value chain with activities spanning exploration & production, processing, refining, marketing, and petrochemical and products distribution. ADNOC regards infrastructure and human resource development as a core strategic objective in order to preserve the industry's competitive advantage. To ensure sustainable energy supplies, ADNOC spares no efforts in exploring the opportunities thriving in the industry such as Enhanced Oil Recovery (EOR), capacity enhancement, and the development of new fields.Enhanced Oil Recovery (EOR) and CO_2 Injection

Harnessing this technology is critical to maintaining the recovery rates of mature fields. Techniques such as water flood, Carbon Dioxide (CO_2) and gas flood can significantly increase the extracted volumes. ADNOC has committed to pursue an EOR strategy in its mature fields as well as in fields operated by ADMA-OPCO and ADCO. Progress has been made and studies are currently being tailored to optimise oil production. For example, Total-ABK is experimenting injecting a polymer and surfactant solution into the field while ADCO is planning CO_2 injection pilot projects.

CO_2 injection has the advantage of substituting natural gas which can then be diverted into the local distribution network to meet increasing demand. In November 2013, ADNOC and Masdar signed a joint venture agreement to create the Middle East's first company focussed on exploring and developing commercial-scale projects for Carbon Capture, Usage and Storage (CCUS). The first CCUS project will capture CO_2 onsite at Emirates Steel, the UAE's largest steel production facility. CO_2 will be compressed and transported along the 50 km pipeline to oil fields operated by ADNOC before it is injected to enhance oil recovery. The project will sequester up to 800,000 tons of CO_2 annually.





Natural Gas

Electricity generation accounts for 60% of UAE's natural gas consumption, and the growth in power demand has created a strategic need to build sector capacity. Most of ADNOC natural gas infrastructure is operated by Abu Dhabi Gas Industries (GASCO). In the last decade, GASCO has undertaken a number of expansion projects to cater to increasing demand. In 2010, ADNOC integrated the onshore and offshore gas networks by commissioning the Offshore Associated Gas (OAG) and Integrated Gas Development (IGD) facilities on Das Island and Habshan in 2012. The Al Hosn Gas project, which is scheduled to be commissioned in late 2014, will utilise the sour gas from Shah Field to supply the natural gas distribution network, as well as produce Natural Gas Liquids (NGL), Condensate and Sulphur products.

Refined Products

The demand for transportation fuels has increased in recent years due to both economic and population growth in the UAE. By 2017, the number of cars per 1000 residents is expected to reach 636 compared to 470 in 2012. ADNOC distribution is the largest petrol supplier in the UAE and has developed an expansion plan to cater to increased demand and coverage requirements. ADNOC distribution has also extended its operations to include alternative fuels through the introduction of Compressed Natural Gas (CNG) in some of its stations. The fast growth in air and marine transportation has also led ADNOC (and its group companies – Takreer and ADNOC distribution) to increase the production of jet and bunker fuels. One important example is the Takreer-Ruwais refinery project which aims to double the production of refined products.

The UAE is witnessing a significant amount of activity within the wider oil and gas industry to ensure the sustainable supplies of energy fuels. This covers a range of activities, including strategic planning, infrastructure development and building human capital. ADNOC is looking at different ways of maximising the potential of hydro-carbons in Abu Dhabi and optimising each part of the industry chain.

The UAE oil and gas industry can act as a catalyst to support the overall development of UAE. Oil remains at the core of the country's energy agenda, and will continue to play a central role going forward. Oil has long been the lifeblood of growth in the UAE and the region. However, the world is changing; energy demand is increasing while energy efficiency and greenhouse gas emissions targets are becoming stricter. Gas is making a larger contribution towards the production of more environmentally friendly power and water and is taking a large share of the energy mix. As a result, ADNOC is undertaking initiatives to extend the gas value chain and explore the future viability of gas as a feedstock fuel. ■

ABOUT DR. SAIF SULTAN AL NASSERI



He holds the position of ADNOC Gas Processing Director and is a member of ADNOC leadership team. Dr. Saif is also the Chairman of Zayed Future Energy Prize Review Committee.

THE UAE GETS ITS TRAFFIC UP TO SPEED FOR EXPO 2020

HOST CITY DUBAI AND THE REST OF THE UAE PREPARES TO WELCOME AND TRANSPORT THE WORLD AROUND IN 2020



About 5.2 million people are expected to be living in Dubai by 2020

ARTICLE

By Waddah S. Ghanem and Alia Busamra

It is a given that fuel and mobility are two of the key factors within the transport sector. Mobility is one of the major themes of the Expo 2020 in the UAE, reflecting the sharp expected rise in the country's population and an increase in trading opportunities. Both of these trends will require an expansion transport infrastructure. The sustainability of this expansion relies on the development of alternatives to fossil fuels.

Mobility is strongly linked to the UAE and the EXPO host city – Dubai. Over 83 million passengers passed through Abu Dhabi Airport and Dubai International Airports in 2013. The port of Jebel Ali, the largest man-made port in the world, is the leading port in the Middle East and the largest container port between Rotterdam and Singapore. In addition, Dubai has commissioned the Al Maktoum International Airport in Jebel Ali, with a capacity to handle 160 million passengers annually. It is expected that at least 70 per cent of Expo 2020 visitors will be from overseas.

Infrastructure development falls under the 2021 national initiative - "A Green Economy for Sustainable Development". There is a focus on the planning of green cities, green buildings, and environmental-friendly transportation; reducing carbon emissions from industrial and commercial sites; promoting the production and use of renewable energy; developing standards for energy consumption in the public and private sectors; and development of green technology.

Based on the World Economic Forum (WEF) Global Competitiveness Report 2013–2014, UAE is ranked first in the world in terms of the quality of its roads and fourth in quality of overall infrastructure. Dubai has a comprehensive taxi and bus system with the latter serving over 193 routes on weekdays, and transporting more than 30 million people per week.

The introduction of Dubai Metro has been instrumental in reducing congestion in certain areas. With testing of the trams on-going, the first phase of Dubai Tram is also expected to be operational in November 2014. According to estimates by RTA, more than 13.2 million users have benefited from marine transport including abras (traditional boats made of wood), water bus, water taxi and Dubai Ferry, with abras accounting for nearly 12 million passengers.

The number of private and commercial vehicles is expected to grow in line with the rising population between 2013 and 2020. Efficient multi-modal environmentally friendly solutions are therefore vital to Dubai's future transportation policy. Dubai's is looking to curb the growth of excess consumption by investing in consumer education, rather than by allowing taxation policies to drive its environmental policy.

Sustainable Growth and Alternatives to Fossil Fuel

Embracing the Expo 2020 co-theme of sustainability, Dubai's infrastructure growth will be supported by the Dubai Integrated Energy Strategy 2030, promoting the efficient use of energy, securing new alternative sources, and minimising the negative environmental impacts on the Emirate. Like Abu Dhabi, Dubai sees great potential in the development of solar energy. It is expected that solar energy could account for 50 per cent of the Expo site's energy needs.

Providing sustainable mobility is a major challenge that will require new vehicle and fuel technologies. Compressed Natural Gas (CNG) is one alternative fuel option for cars in the UAE. Government vehicles will switch to CNG first, followed by private vehicles. Within the next five years, CNG will be available as an environment-friendly alternative to petrol or diesel. Emirates Transport, the RTA, Abu Dhabi Police and Dubai Police, together with some transport companies, are now taking steps towards shifting to CNG. A CNG vehicle's carbon footprint is about 75 per cent of that of comparable gasoline model.

In Dubai, ENOC's subsidiary Emirates Gas (EMGAS) is working closely with the municipality in a novel project to recover methane generated from the sewage treatment plant and convert this waste gas to CNG for vehicles. This project is also likely to be registered to gain carbon credits through the Dubai Carbon Centre of Excellence. Upon completion of the project, it is estimated that EMGAS will potentially be able to provide CNG for approximately 15,000 passenger cars and light commercial vehicles per day.

Meanwhile ENOC has established a Diesel Engine Promotion Committee to formulate a strategy to promote Diesel Engine technology, as it is more efficient compared to Petrol Engine. However the availability of diesel in UAE is low and there are competing uses for it in stationary engines and power generation.

Electric cars are another option that is being explored. The Dubai Electricity and Water Authority (DEWA) intend to test 100 electric cars in its own fleet over the next two years and then discuss the possibility of implementing the same within RTA, Dubai Municipality, Emaar, Dubai Holding and Nakheel.

ENOC has shown its strong commitment to support green transport infrastructure. It has completed a recent study on the fuel efficiency, carbon and pollutant emissions from petrol vehicles in Dubai, as a starting point to estimate the volumes of GHGs and pollutants from petrol vehicles. When scaled up to the total number of petrol vehicles in Dubai, the emissions of CO_2, CO and HC were calculated to be about 3,500,000; 107,000 and 2700 tonnes per year respectively and these levels exceed the national benchmarks by more by 80 per cent, 300 per cent and 33 per cent respectively.

Furthermore, ENOC has recently signed a Technical Services Agreement (TSA) with Dubai Carbon Centre of Excellence (DCCE) to manage the carbon footprint of ENOC's operations and to develop the competencies of ENOC staff members in promoting Clean Development Mechanism (CDM) projects. This agreement is aligned with the green vision of Dubai. It will complement the efforts of the ENOC Group Environment, Health, Safety and Quality Compliance (GEHSQC) team in developing a carbon footprint calculator and abatement strategy. Dubai Carbon will also extend its expertise to create a screening mechanism for CDM projects and other low-carbon opportunities, supporting the sustainability goals of ENOC.

> Over 83 million passengers have gone through Dubai International and Abu Dhabi Airports in 2013.

Based on official forecasts, about 5.2 million people are expected to be living in Dubai by 2020. As a result of this increase, mobility patterns in Dubai are expected to undergo significant change. Several planning guidelines have been established to ensure accelerated and sustainable infrastructure growth. The development of the Emirate's transport system is running in parallel to the creation of its carbon abatement strategies and diversification of its energy sources. Dubai will have to tackle the challenge of balancing the two while building the necessary transport infrastructure to meet the demand. ■

FACT BOX

By Waddah S. Ghanem and Alia Busamra

ENOC's path to sustainability

One of the guiding principles of the Dubai Strategic Plan for government entities is to integrate sustainability as a key element of the organisation's core values: ENOC adheres to sustainability as a way of operating.

This is underlined by the introduction of the Euro 5 standard ultra-low-sulphur diesel fuel standards across the ENOC/EPPCO network. As part of its commitment, ENOC is absorbing the extra cost of this environmentally-friendly fuel with lower greenhouse gas emissions. Encouraging customers to adopt green fuels, ENOC is also actively promoting the use of Compressed Natural Gas (CNG) as a cleaner and greener automotive fuel.

Emirates Gas (EMGAS), a wholly-owned subsidiary of ENOC, has commenced operations of its state-of-the-art CNG Mobile Filling Unit, while the CNG Mother Station in Jebel Ali delivers CNG to potential customers. Emirates Authority for Standards & Metrology has officially nominated ENOC and EMGAS as the implementing agency for CNG activities in the UAE.

ENOC has signed an Agreement with Dubai Carbon (DCCE) to effectively manage the carbon footprint of ENOC's operations and to develop the competencies of its staff members in promoting Clean Development Mechanism projects.

ENOC is also credited with the Middle East's first 'green service station.' It uses the latest technology to recover 99 per cent of the vapour from the dispensers and storage tanks, and has solar powered lampposts and LED lights. EMGAS has launched several environment-friendly measures including the Cutting Edge Gas, while ENOC Retail has introduced the 'go-green' waterless car wash that does not use a single drop of water.

Another path breaking initiative is Tadweer, aimed at encouraging the public to donate their used laptops, which will be recycled, refurbished and donated to educational, social and charitable institutions.

Going green is a commitment across ENOC's internal operations too. Several green measures have been introduced such as replacing all systems with ozone-friendly appliances and the use of LED/solar lights. As a result, ENOC's headquarters saw a reduction of 48 per cent in water use and 78 per cent in energy use in 2012 compared to 2010. ■

ABOUT WADDAH S. GHANEM



He is the Director of EHSQ Compliance and Chief EHSQ Compliance Officer for the ENOC Group of Companies. He is also a vice-chairman of the Dubai Carbon.

ABOUT ALIA BUSAMRA

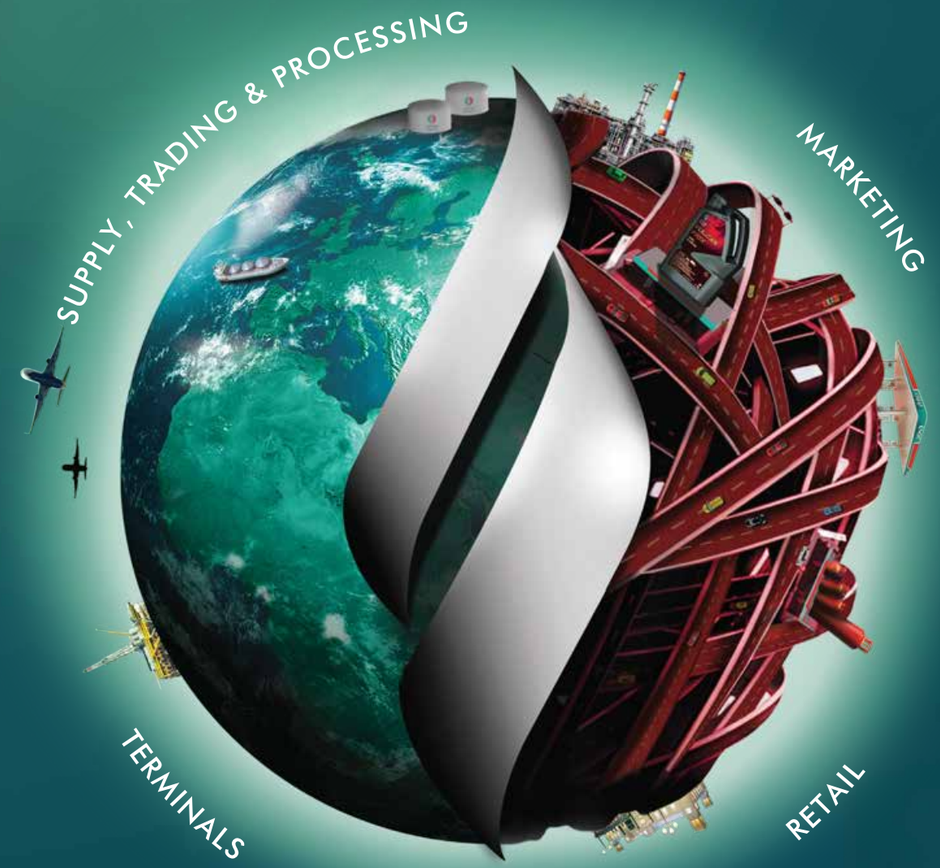


She is a Senior EHS Compliance Officer (Environment & Energy) at the Emirates National Oil Company Limited (ENOC).

ENOC

Behind every successful journey

From Dubai to the world, ENOC provides the energy that drives phenomenal growth. Supporting with Oil, Gas, Refined Petroleum Products, Storage Facilities, Retail Service Stations, Aviation Fuel, Lubricants and Terminaling, we touch almost every facet of people's lives. Responsible, reliable, innovative and growing, we're the: Energy Partner of Choice.



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Energy Partner of Choice

LET'S TALK SUSTAINABILITY

THE GROUP VICE PRESIDENT HSSE OF TAQA ON THE SUSTAINABILITY CHALLENGES OF AN ENERGY COMPANY

COMMENTARY

By Hadi Al Badi



By 2050, the world's population will have grown to require twice as much energy as it does today. It cannot all come from fossil fuels. At TAQA, we have already started the search for cleaner, more sustainable power.

For an energy company like TAQA, you might think a conversation about

sustainability would be a difficult one. After all, most of what we do is extracting and burning fossil fuels so that you can run your cars and light your homes, and so that businesses can run factories and generate the wealth we all depend on.

Yet at TAQA, one of our core values is to be sustainable. Burning fossil fuels might be the most economical alternative to provide the power the world needs, but burning these fuels could hardly be considered sustainable. They are finite resources, and producing them generates unsustainable consequences such as greenhouse gas emissions and other pollutants.

So how do we at TAQA address this contradiction? Well, for a start, we have to. If we cannot sustain our business, there is not much point in holding a conversation on sustainability.

Sustaining Our Business

The nature of energy industry is intrinsically hazardous. Our top priority is safety; for the 3,300 workers in our TAQA family, for our contractors, and for the environment entrusted to our stewardship – this is a key part in maintaining our license to operate.

Second, we have to generate returns for our investors. That does not mean being in business for short term gains, but rather demonstrating that we are in it for the long haul. To do that, we need to take care of our customers in all the countries in which we operate. And that does not mean just being more efficient at extracting oil from the North Sea or Iraq, or generating electricity in Ghana or India.

In the short term, it means being good neighbours by ploughing back some of our returns into social development and public infrastructure projects near our installations. We also partner with local businesses in our field of operations, helping these communities to benefit from our presence in terms of jobs and economic activity. In the long term, it means research and development and the
global picture.

The Energy Challenge

There is a consensus among the think tanks that, by mid-century, the population of the planet will have grown from its current seven billion to nine billion, and that 70 per cent of that population will be living in cities.

The result will be a level of energy demand that is twice what it is today. Already, what we would call 'a decent standard of living' requires that we each consume about 3,000 kilowatt-hours (kWh) per year. So, from somewhere, we're going to have to generate more than 30 tonne kWh per year by 2050. And it cannot all come from fossil fuels.

According to the International Energy Agency (IEA), if global energy demand grows by more than one-third up to 2035, emissions will correspond to a long-term average global temperature increase of 3.6°C, well above the 2°C rise deemed acceptable by the Intergovernmental Panel on Climate Change in 2005.

Other estimates are far grimmer. Some environmentalists believe that we can only emit 565 more gigatonnes of carbon dioxide by mid-century and still stay below 2°C of warming. Burning the fossil fuel that corporations now have in their reserves would result in the emission of 2,795 gigatonnes of carbon dioxide (CO_2) – five times more.

Developing Solutions

So at TAQA we are looking at more efficient ways of generating power from fossil fuels, and at developing alternative sources.

Take Ghana, where our Takoradi power plant represents 15 per cent of the country's generating capacity. We are converting it to run as a combined-cycle facility, where one generator runs off the heat from another. As a result, capacity will jump from 220 megawatts (MW) to 330MW without requiring any more fuel and without generating one more gram of CO_2. Or the US, where our Lakefield wind farm in Minnesota generates over 200MW from 137 turbines – enough to power almost 70,000 homes.

And take India, where our hydroelectric plant on the Sorang Khad River, which flows from the Himalayas, will be capable of generating 100MW of renewable energy.

We can burn no more than one-third of proven reserves of fossil fuels up to 2050 if the world is to achieve the 2°C goal, says the IEA – unless carbon capture and storage (CCS) technology is widely deployed. At TAQA, we are studying the possibility of developing an offshore storage site in the Netherlands that will be capable of taking more than 1 million tonnes of CO_2 out of the atmosphere per year.

Together, these ventures add a new dimension to our fossil fuel business. We are not just contributing towards the sustainability conversation; we are acting towards achieving sustainability.

Energy is not just fundamental to our quality of life and the prosperity of the world; it is necessary. So when we at TAQA say sustainability is one of our core values, it means we do not just like to have conversations about it – we like to act on it, too. ■

> "We can only emit 565 more gigatonnes of carbon dioxide by mid-century and still stay below 2°C of warming."

ABOUT HADI AL BADI



He is the Group Vice President of Health, Safety, Security, and Environment at TAQA. An Emirati National, Hadi previously held various positions at Abu Dhabi Marine Operating Company (ADMA-OPCO), and the Dolphin Energy Qatar-UAE gas pipeline project.

COMPRESSED NATURAL GAS (CNG) A CLEANER ALTERNATIVE FUEL

CASE STUDY UAE

By Dr. Saif Sultan Al Nasseri

Internal combustion engines, using petrol or diesel, release harmful greenhouse gases (GHG) that contribute to global warming. This is forcing car manufacturers and legislators to push for solutions that reduce emissions and to adopt alternative fuels. There is increasing global interest in alternative fuel vehicles such as electric cars and those which run on compressed natural gas (CNG).



The UAE is blessed with a high level of fuel station coverage providing petrol and diesel. To cater to the switch to alternative fuels over the coming decades, fuel suppliers have started providing compressed natural gas (CNG) in some fuel stations, and some organisations have converted their vehicles to CNG as part of their environmental commitment.

Environment-Impact Conscious

Abu Dhabi is seeing a major shift in the power generation sector, relying more on natural gas as a clean and environment-friendly source of energy. Climate change is likely to have negative impacts on natural eco-systems in both Abu Dhabi and the wider UAE. Maintaining a strong balance between development and environmental preservation is a strong policy focus.

In terms of environmental sustainability, Abu Dhabi is going from strength to strength by adopting a range of environmental policies and goals, and pursuing initiatives such as Alternative Fuels like CNG. Such goals are taken forward by different government entities. For example, in May 2014 Abu Dhabi City Municipality added 150 natural gas-powered vehicles to its vehicle fleet as part of its strategic plan aimed at conserving the environment. These vehicles use a clean energy source and meet international standards of sustainability.

What is CNG?

CNG is a lower-carbon transport fuel that can be used as an alternative to petrol and diesel in countries with a natural gas supply and distribution network. CNG is manufactured by compressing natural gas, consisting primarily of Methane (CH4). CNG is stored at 1% of its volume at atmospheric pressure. CNG has lower levels of harmful emissions when compared to Petrol, Diesel or LPG. CNG vehicles also have the advantage of lower maintenance costs. CNG's volumetric energy density is estimated to be 42% that of liquefied natural gas and 25% that of diesel fuel.

The efficiency and performance of CNG vehicles are equal to traditional fossil fuel engines. Two models of CNG vehicles currently exist; the first is dual fuel variant (CNG and Petrol/Diesel) with the second a CNG-only engine. Transforming a car to European Union standards currently costs about 8 to 9 thousand Dirhams. However, the running cost of using CNG is 30% less than using petrol.



ADNOC CNG Initiatives

A pioneer in its commitment to Abu Dhabi society, ADNOC group is leading this shift to CNG. This is spearheaded by ADNOC Distribution, which brings together all the capabilities, experience and know-how to plan and execute this strategically important task. As part of the ADNOC group's commitment towards environment protection, ADNOC Distribution introduced CNG as a fuel in 2008 to reduce harmful emissions, to ensure a healthier environment and to support the Abu Dhabi Economic Vision 2030. The project will have a positive impact on the community by supporting a change in transport fuel mindset, promoting the use of natural gas as a lower cost alternative, and promoting a safer and healthier environment.

To accomplish the objective, under Phase 1 of the Natural Gas Vehicle "NGV" Project, 17 CNG units were installed at strategic ADNOC distribution stations across the UAE. This included 11 units in Abu Dhabi, 2 units in Al Ain and 4 units in Sharjah. Together, these had a peak capacity of 10,000 cars per day, and have brought significant emission reduction benefits in CO, CO_2, non-methane hydrocarbons and NOx emissions.

The number of natural gas filling stations and conversion stations under ADNOC's NGV project has continued to increase steadily. During 2013 ADNOC Distribution opened 1 filling station making a total of 17 filling stations and 8 conversion stations. ADNOC group has supported this programme through the conversion of several vehicles and the procurement of original CNG buses direct from the manufacturer.

ADNOC and its group of companies remain committed to achieving the environmental vision of both Abu Dhabi and the UAE. They have a commitment to harness experience and pursue new initiatives that that will support both society and the environment. ADNOC health and safety objectives clearly indicate the importance of reducing environmental impacts by seeking to eliminate hydrocarbon flaring, reducing emissions and improving energy efficiency. Compressed Natural Gas (CNG) vehicles are one of the technologies that ADNOC believes will help it to achieve these objectives. ■

NATURAL GAS

ABOUT DR. SAIF SULTAN AL NASSERI



Dr. Saif Sultan Al Nasseri. He holds the position of ADNOC Gas Processing Director and is a member of ADNOC leadership team. Dr. Saif is also the Chairman of Zayed Future Energy Prize Review Committee.

INNOVATION FOR A SUSTAINABLE FUEL FRAMEWORK

> The large number of mega-projects with a combined value of US$2.62 trillion signifies an increase in the demand for power, water and fuel.

COMMENTARY

By Saeed Khoory

MAXIMISING DOMESTIC ENERGY PRODUCTION AND EFFICIENCY WHILE SIMULTANEOUSLY EXPLORING THE POTENTIAL FOR RENEWABLE ENERGY SOURCES IS KEY TO A 'GREEN' FUTURE



The energy sector of oil-rich countries in the Gulf region faces a curious dilemma that is little discussed. While the use of oil revenues to finance infrastructure development is well-accepted, discussions on the implications of domestic demand are often limited to industry forums that fail to generate much public attention.

From a historical perspective, the Gulf region is today witnessing an energy sector challenge that is unprecedented. The era of self-sufficiency and energy surplus is giving way to concerns about rising fuel prices and net imports.

Two factors have brought about this dramatic shift in the long term outlook for the oil and gas sector. The first is a growing population that results in steadily increasing demand for power, fuel and energy resources. The second is the massive investment in infrastructure development across the region to drive social growth through job creation and greater economic competitiveness. While new infrastructure is both welcome and needed, the large number of mega-projects with a combined US$2.62 trillion in value signifies an increase in the demand for power, water and fuel.

This is where the region faces its dilemma; utilising more oil and gas reserves to meet growing domestic energy demand results in fewer resources available for export, which in turn reduces foreign exchange reserves and limits the future budget allocation for infrastructure development.

In addition, changing global energy dynamics and the development of new technologies, such as the shale gas revolution in the US, may result in cheaper sources of fuel increasingly coming on to the market.

For the energy sector in the region, the key to overcoming this challenge is to focus on two important aspects. The first is to maximise production and operational efficiency in the energy sector, and the second is to explore the potential for renewable sources of energy.

> One of the central initiatives of ENOC to promote a sustainable fuel industry is accelerating the use of Compressed Natural Gas (CNG).

The UAE is a strong advocate of both these strategies, which is reflected in the Dubai Integrated Energy Strategy 2030 by the Supreme Council of Energy. Dubai's long-term strategy is to diversify the energy mix by including sustainable sources such as solar and clean coal, and to reduce energy and water demand by 30 per cent through efficiency improvements and public awareness.

For the automotive industry, this represents a strong opportunity for a transformational shift to greener, cleaner and more efficient alternatives. Dubai is leading the way with plans to install electric vehicle chargers that power vehicles that are non-polluting and not dependent on traditional fuels.

Such innovative approaches are critical in creating a sustainable framework for the fuel industry. ENOC has been at the forefront of strengthening awareness of sustainable energy solutions, and has introduced several ground-breaking initiatives to help develop a greener fuel industry. Our emphasis is on ensuring that every molecule of fuel, wherever possible, is conserved.

One of the central initiatives of ENOC to promote a sustainable fuel industry is accelerating the use of Compressed Natural Gas (CNG) as a cleaner and greener fuel for automobiles. Emirates Authority for Standardisation & Metrology, the UAE's sole standardisation body, has officially nominated Emirates Gas (EMGAS) as the implementing agency for CNG activities in the UAE.

Already, EMGAS has a CNG mother station located close to its facilities in Jebel Ali, from where dedicated CNG tankers receive and distribute the fuel to customers including DP World, Dubai Police and Dubai Airports.

Three dedicated CNG daughter stations have been installed at the premises of EMGAS customers for the quick and efficient distribution of CNG.

EMGAS also owns and operates a CNG mobile filling unit, which distributes CNG to customers on a demand-driven basis. Several governmental entities and private businesses are in discussions with EMGAS to convert their vehicle fleet to CNG. Popularising the use of CNG helps achieve both demand and supply side efficiency in addition to curbing greenhouse gas emissions and particulates that pollute the air.

To promote energy efficiency, ENOC has undertaken other steps such as the inauguration of the first-of-its-kind 'green service station' in the Middle East. It employs the latest technology to recover 99 per cent of the vapour from the dispensers and storage tanks, and has solar powered lampposts and LED lights with a lifespan of up to 50,000 hours. Innovation around the provision of green fuel products and services is another focus area to promote environmental sustainability.

While several Dubai governmental entities have expressed their support for initiatives such as CNG fuel, greater results can be achieved with the full support of the wider public and all energy sector stakeholders.

Working together to create a sustainable and broad energy framework is central to our mission to achieve the 'green vision for sustainable development' announced by His Highness Sheikh Mohammed bin Rashid Al Maktoum, UAE Vice President and Prime Minister and Ruler of Dubai.

For Dubai, going green is a commitment that feeds in to the city's ambition to being one of the smartest in the world. The thought leadership of Dubai in promoting a greener future is demonstrated in its approach to Expo 2020, which promotes sustainability as a core theme.

To achieve real results and to fulfil the vision of the leadership, the true catalyst will be our commitment to innovate and adapt. This must start at the grassroots level and be integrated across our entire energy framework.

We need our students, residents and businesses to become active partners in this journey going forward. Each drop of oil saved is an asset that we leave behind for our future generations. Every small step we take is indeed an investment in our future. ■

ABOUT SAEED KHOORY



He is the Chief Executive Officer of ENOC and a Member of the Dubai Supreme Council of Energy

ADNOC SOUR GAS PROJECTS

CASE STUDY UAE

By Dr. Saif Sultan Al Nasseri

USING INNOVATION TO MEET INCREASING GAS DEMAND

The global trends of increasing population and economic growth are putting pressure on existing fuel sources. Governments are seeking to meet such demand with a greater emphasis on natural gas as one of the cleanest and fast growing sources of energy. The UAE is experiencing the same dynamics. Stakeholders including the federal and local governments, energy regulators, producers and consumers are cooperating in the development of polices and initiatives to cater to this increasing demand.



As a major player in the UAE generally and Abu Dhabi in particular, Abu Dhabi National Oil Company (ADNOC) is using the latest technology to harness the potential of challenging sour gas fields such as Shah, in order to diversify the local energy mix.

Increasing Trend

With a growing population, the UAE is exploring solutions to satisfy the increasing demand for natural gas to generate electricity, produce clean water, and supply industries such as aluminum and steel.

The emirate of Abu Dhabi is also experiencing a long-term increase in natural gas demand. This is putting huge pressure on gas supplies and has resulted in the adoption of new measures to mitigate against the risk of a potential future supply-demand gap. Abu Dhabi is therefore pursuing a policy of energy diversification and implementing strategic projects to meet increasing energy demand. ADNOC is a key contributor to this policy, and is leading the execution of a number of strategic gas projects.

ADNOC Initiatives

As a major natural gas producer, ADNOC has pursued several initiatives to increase natural gas production. These include linking the offshore gas and onshore networks through the successful commissioning of the Offshore Associated Gas (OAG) and through expanding the Integrated Gas Development (IAD) facilities on Das Island and the Habshan complex.

ADNOC efforts also include the development of those onshore and offshore reservoirs currently in production for both associated and non-associated gas. Activities include well appraisal, drilling and injection. ADNOC is also considering the potential for developing onshore and offshore sour gas fields. These sour gas projects are technically challenging, due to the high concentrations of corrosive hydrogen sulfide (H_2S) and carbon dioxide (CO_2) and the remote location of the Shah Field.



Shah sour gas field development project

LINKS

http://www.arabianoilandgas.com/article-7477-shah-sour-gas-field-development-project-awards-pmc/

Shah Gas Development

Abu Dhabi Gas Development Company (Al Hosn Gas, a joint venture between ADNOC and Occidental) was established in 2010 to develop sour gas reservoirs located in the Shah Field. These reservoirs were discovered in 1966 approximately 180 Kilometers Southwest of Abu Dhabi. The field has a H_2S concentration (23%) making it an extremely challenging project.

The fact that this is a green field development in a remote area only adds to the challenges of the high H_2S concentration and associated sulfur production. The utilisation of sour gas has now been made possible thanks to advances in technology, significant research and development, and advances in health and safety standards.

The Shah gas development project consists of both upstream and processing/utilities facilities, as well as sulfur production, granulation and transfer facilities. The plant will be capable of producing sale gas in addition to the daily production of Natural Gas Liquids (NGLs), condensate and Sulfur which will be transported by rail to Ruwais terminal for export.

Shah Gas Development has brought in expertise from the ADNOC group, Occidental, and other contractors and consultants to ensure the success of this unique project. It is using the latest technologies, best practices and management approaches.

Other Fields

In addition to the Shah Field, ADNOC is investigating the potential of as yet undeveloped onshore and offshore gas reservoirs to supply additional gas to the local market. Significant progress has been made in compiling and analysing existing seismic and well data. Natural gas is an important component of the UAE and Abu Dhabi energy mix. Ensuring the sustainability of supply helps support both the local population and economic growth. Utilising the sour gas fields is one of ADNOC top priorities in order to create additional gas supplies, recover gas liquids, deploy advanced technologies and gain valuable experience.

ABOUT DR. SAIF SULTAN AL NASSERI



Dr. Saif Sultan Al Nasseri. He holds the position of ADNOC Gas Processing Director and is a member of ADNOC leadership team. Dr. Saif is also the Chairman of Zayed Future Energy Prize Review Committee.

SHRINKING THE FOOTPRINT

A PROGRESS REPORT ON MANAGING THE IMPACT OF CO_2 EMISSIONS FROM POWER AND WATER PRODUCTION

> A carbon capture and storage project designed [has been designed] to remove 800,000 tons of CO_2 a year by 2015 from the Emirates Steel facility.

COMMENTARY

By Bruce Smith



The UAE has one of the highest levels of per capita CO_2 emissions in the world, at just under 20 tonnes per head of population in 2010. A harsh climate, energy subsidies and a rapidly developing economy have combined to create an environment in which consumption of fuel, electricity and water is inevitably high. Unsurprisingly, the power and water sector is the largest consumer of fossil fuels and accounts for around half of all emissions. Despite the challenges, action is being taken and real progress has already been made to scale this back.

Total CO_2 emissions in the UAE increased by 63 per cent between 2000 and 2010, according to the International Energy Agency - a significant increase. However, over the same period in Abu Dhabi, power generation increased by 185 per cent and water production by 213 per cent. The major contributor to improving efficiency, reducing costs and limiting emissions has been the reduction in the specific fuel consumption of ADWEA's generation fleet. Fuel required per unit of electricity and water produced fell by 30 per cent between 1999 and 2013, saving 18 per cent of the total fuel that would otherwise have been used in this period had these efficiencies not been achieved, and providing a similar reduction in the associated CO_2 produced.

So what does the future hold? The rate of increase in the demand for electricity is expected to slow to an average of 5.5 per cent a year up to 2030 and the rate of increase in water supplied to end consumers is also expected to fall from its historic average growth of almost 10 per cent a year between 1998 and 2012 to around 2 per cent between 2014 and 2030. The introduction of 5.6 GW of nuclear capacity to the current UAE capacity of circa 25 GW is expected to provide over 25 per cent of the UAE's total anticipated energy needs when commissioned, and is projected to result in the CO_2 intensity associated with electricity production dropping a further 40 per cent from its 2010 baseline. This will be further supported by the UAE's commitment to renewable energy, which in turn has been boosted by significant falls in the price of electricity generated from solar power since 2010.

The impact of water production on overall emissions, however, cannot be ignored. At present, virtually half of all fuel and associated emissions are directly linked to water production. Abu Dhabi's existing stations are designed to efficiently produce power and water together by utilising 'waste' heat from power production. This reduces the amount of additional fuel needed for thermal desalination, resulting in a process that can be up to 90 per cent thermally efficient. The efficiency of these plants, however, can fall by 40 per cent when the power demand is reduced relative to water demand, such as occurs during the cooler winter months.

The commissioning of nuclear powered base-load generation has the potential to result in the existing water production facilities being forced to operate far less efficiently.

> stand-alone desalination technologies are expected to provide up to 30 per cent of the total installed capacity required by 2030.

> The efficiency of these plants however can fall by 40 per cent when the power demand is reduced.

To tackle this challenge, stand-alone desalination technologies, such as reverse-osmosis based plants, are being actively developed. These offer the additional benefit of being able to utilise remotely produced nuclear and renewable energy. Whilst reverse-osmosis units have been successfully incorporated in two of ADWEA's plants in Fujairah since 2005, Abu Dhabi's first plant utilising this technology inside the warmer and more saline waters of the Arabian Gulf itself is expected to become operational during 2016. Looking further into the future, stand-alone desalination technologies are expected to provide up to 30 per cent of the total installed capacity required by 2030.

Supporting this drive for energy-efficient stand-alone desalination, Masdar is currently leading an 18-month pilot study to test and prove the capabilities of four innovative stand-alone technologies. These trials could pave the way to further significant reductions in the overall energy intensity and emissions associated with producing fresh water by desalination in the UAE and beyond.

Masdar is also working on a carbon capture and storage project designed to remove 800,000 tons of CO_2 a year by 2015 from the Emirates Steel facility and inject it into ADCO oil fields to boost production. The phased development of a pipeline network to facilitate Carbon Capture and Storage (CCS) for heavy industries such as steel, aluminium and refineries as well as utility generators, has the potential to support sustainable industrial economic development. The freeing up of natural gas that would otherwise have been re-injected in order to boost oil production provides further support, whilst also assisting with oil reservoir maintenance and boosting reserves. Finally, the sequestration of carbon in depleted oil fields can help support a global response to reducing the impacts of climate change.

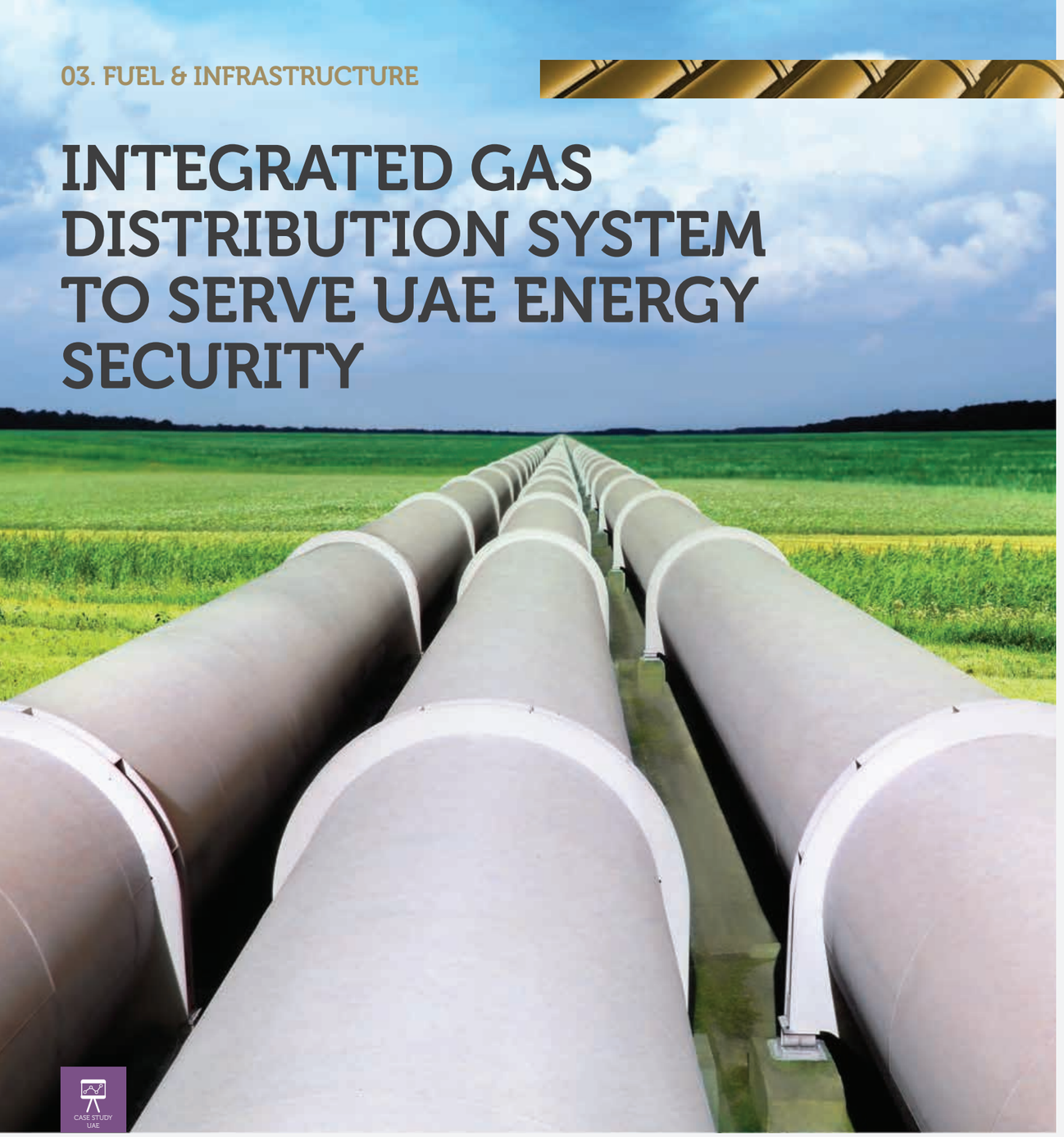
The last decade has seen dramatic improvements in the efficiency of power and water production but also a substantial increase in the demand for both. By the end of the coming decade, in addition to continuing efficiency gains as a new conventional gas fired plant is commissioned, we expect a rapid and profound shift towards low carbon generation technologies led by the UAE's nuclear programme and supported by renewables. ■

ABOUT BRUCE SMITH



He has recently joined ADWEC as an advisor, focusing on the Abu Dhabi sector's resource planning function and production efficiency.

INTEGRATED GAS DISTRIBUTION SYSTEM TO SERVE UAE ENERGY SECURITY



CASE STUDY
UAE

COOPERATION BETWEEN THE UAE'S ENERGY PLAYERS HELPS GENERATE EFFICIENCIES AND SERVES UAE ENERGY SECURITY

Background

In order to support the company's vision to be a reliable supplier of natural gas to the UAE and Oman, Dolphin Energy realised that it required access to a country-wide gas transportation network with sufficient capacity.

> The development of the 182 kilometre, 24 inch Al Ain to Fujairah Pipeline has helped transport gas from Oman to Fujairah.

Response

In 2002, when Dolphin Energy was incorporated and its role defined, provision was made for the construction of a gas distribution network. However, in 2005, the company signed an access agreement with ADNOC to use the existing Eastern Gas Distribution System (EGDS).

Rather than have two systems to serve the UAE, the agreement also allowed Dolphin Energy to upgrade the network where required and then take over the operations of the system which was operated by GASCO on behalf of ADNOC.

In July 2007, the company entered into a 25-year lease agreement to operate, manage and transport natural gas to its customers and to those of ADNOC in the Eastern Region that relied on the existing system. Dolphin Energy also worked closely with ADNOC and GASCO to ensure natural gas supply across the UAE would be maintained at all times.

> Rather than have two systems to serve the UAE, the agreement allowed Dolphin Energy to take over the operations of the system.

Dolphin Energy took over full operation and management of the EDGS in July 2008. By that time it had already responded to the increasing requirements of its customers by expanding the network, with the development of the 182 kilometre, 24 inch Al Ain to Fujairah Pipeline that transported gas from Oman to Fujairah when volumes from Qatar were unavailable. Further expansions of the network took place in 2010 with the construction of the 244 kilometre, 48 inch Taweelah-Fujairah Pipeline. Both were developed in specific response to customer's requirements for increasing volumes of natural gas on the eastern coast of the emirates.

Results

Today the Eastern Gas Distribution System performs like an artery – providing the life blood for the UAE to continue its quest for economic diversification and development.

The network has been instrumental in making power generation and water desalination more efficient, supporting industrial growth, meeting the demands of a growing population, and supporting customers as they continue to grow.

It also boasts flexibility in its capacity to send volumes to power plants and industrial corridors. Arrangements for future expansion of the EDGS that will ensure supply to current and future customers are under consideration. Network flexibility is further illustrated by the ability to absorb imported LNG at Fujairah should the need arise.

In delivering significant quantities of natural gas across the country reliably and safely, the EGDS has helped to reduce the need to use alternative fuels required for power generation, which in turn has saved billions of dollars and supported the transition to a low carbon economy.

The Eastern Gas Distribution System has become a symbol of integration, cooperation and collaboration, helping to define the success of the Dolphin Gas Project. From the early days of the agreement struck with ADNOC, the use of Omani gas in UAE power plants signified the first time gas flowed from one GCC nation to another. More recently, the expansion of the network has been central in meeting the changing requirements of customers. ■





POWER FOR THE PEOPLE

CASE STUDY INTERNATIONAL

TAQA

HOW A UAE-BASED ENERGY AND WATER COMPANY IS ECONOMICALLY EMPOWERING THE PEOPLE OF GHANA

Eric Tackie is very much like the instruments he operates – reliable and built for the long haul. Married with three young children, the 37-year-old technician has worked at TAQA's Takoradi 2 power plant in Ghana for the past 12 years and loves his job.

The unassuming Mr Tackie has been an integral part of the team that converted the plant from oil to gas and is visibly proud of his achievements. A broad smile lights up his face when he talks of the project. "I'm the instrument and control technician," he says with a hint of pride. "I'm responsible for the various instruments such as the temperature detectors and the pressure transmitters. I was also part of the team that was involved in the installation of the gas conversion system."

> "Takoradi 2 will generate 330MW of power, thereby making up for 15 per cent of Ghana's electricity supply and light up the homes of one million people."

The project took six weeks to complete in 2011 and paved the way for major expansion plans at the power plant, which nestles on the southwest coast in Aboadze just outside the oil port of Takoradi.

When the US$330 million development is finished next year, Takoradi 2 will generate 50 per cent per cent more power as capacity increases from 220 megawatts (MW) to 330MW. This will make up for 15 per cent of Ghana's electricity supply and light up the homes of one million people.

"We are using our own gas here," says Mr Tackie. "This will help our expansion project. It will boost our power output, which in turn will help the country expand economically."

Economic Expansion

Expansion has become a buzzword in Ghana. The country's US$39 billion economy grew by 14.4 per cent in 2011 and 8.5 per cent in 2012. However to fuel economic growth, Ghana needs power to diversify an economy based on oil, gold and cocoa production. Electricity will be needed to turn the wheels of a thriving manufacturing sector, an expanding financial industry and a nascent IT business. And this is where TAQA comes in.

"The Takoradi 2 expansion project reflects our energy for growth programme aimed at increasing investments in the sector to build capacity for the future," says John Dramani Mahama, President of Ghana. "The role of independent power producers has become vital and the partnership of TAQA and Volta River Authority [the country's main energy supplier] has demonstrated that Public-Private Partnerships (PPP) work in Ghana."

Providing jobs and improving the standard of living in the Aboadze region reflect that approach. Already, roads, clean-water projects and drainage systems have been constructed. Funding for healthcare and education has also increased.

"As an international company, TAQA has integrated itself well in the region," says Benjamin Abeiku Otoo, Human Resource Officer, Administration, in Ghana. "We have shown we have social awareness. Before TAQA came, the area lacked many facilities for local people. In fact, there wasn't even a road," he says.

"But we have changed that. We have looked at the culture here and reached out to the people with medical and educational projects. We have also built infrastructure." Across the country it is a similar story. A building boom is helping to drive growth with a US$10bn high-tech hub known as Hope City planned for just outside the capital, Accra, by 2016.



The futuristic project is the brainchild of businessman Roland Agambire, who runs RLG Communications, and was launched by President Mahama. In an interview to CNN, Mr Agambire says, "What is lacking in the African continent is a place where you can have well-designed products, backed with concrete research, and proper hardware and software developers to be able to create infrastructure for the telecoms industry."

"So the inspiration behind Hope City is to have an iconic park where technology players from all over the world can converge to design, fabricate and export software and everything arising from this country."

BY THE NUMBERS

US$ 330 million — The cost of expanding the Takoradi 2 plant. Work will be completed next year and the plant will generate 50 per cent more power as capacity increases from 220MW to 330MW

15% — The amount of electricity the Takoradi 2 power plant will generate for the Ghanaian national grid when the expansion project is finished

12 — The number of years that Eric Tackie has worked at the Takoradi 2 power plant. He is married with three young children, aged nine, seven and five

24 mn — The number of people who live in Ghana, which is considered an economic and political role model for the West African region. But unemployment in the 15-24 age group remains high

8% — The projected growth figure for Ghana this year. In 2011, the economy grew by 14.4 per cent before slowing to 8.5 per cent in 2012. But that still outstripped the sub-Saharan African average

47% — The rise in Ghana's wage bill between 2011 and 2012. The International Monetary Fund has called on the country to curb this and reduce double-digit interest rates





Formidable challenges

With a population of more than 24 million, Ghana has been hailed as a role model in West Africa for political and economic reform, attracting US$5.63bn in foreign investment last year. But there are still challenges to be resolved. The International Monetary Fund (IMF) has called on Mr Mahama's administration to cut double-digit interest rates and rein in a wage bill that jumped 47 per cent from 2011 to 2012.

Concerns have also been expressed about a growing power shortage. "The energy sector problems and the high interest rates will curtail private-sector growth," says Christina Daseking, leader of the IMF mission in Ghana. "We are urging the government to gain back control of the wage bill."

Energy subsidies, spiralling wages and other increases helped swell the budget deficit to around 12 per cent of GDP in 2012.

The government's target was 6.7 per cent. "The gap is probably going to stay at a high level of 10 per cent," says Ms Daseking. "Excessive government borrowing is raising the cost of credit to the private sector. And a ballooning wage bill, if untamed, will bring debt to levels that could endanger the government's transformation agenda."

In a move to rebalance the economy, the government aims to cut the deficit to nine per cent of GDP this year and six per cent by 2015. "Any attempt to correct the fiscal imbalance in one year would be extreme," says Kwesi Amissah-Arthur, Ghana's Vice President. "We'd be putting the brakes on at a time when we also have the responsibility to ensure economic growth to create employment opportunities."

Back at the Takoradi 2 plant, Mr Tackie is excited about his country's rapid economic rise. "The power we supply will help other businesses in the country and bring in new investment. This has to be good for my country. It will help us move forward towards an even brighter future." ■

FOOTNOTES

1 Eric Tackie is the instrument and control technician at Takoradi 2.
2 Takoradi 2 has been converted from oil to gas.
3 Capacity at Takoradi 2 will increase from 220MW to 330MW.

CREATING BIOFUEL FROM USED COOKING OIL

OVER 5,000 VEHICLES RUN ON BIODIESEL MADE IN THE UAE WITH ZERO IMPACT ON CROPS

> A concerted effort by the government, waste management companies, biofuel producers and fuel companies, can create a robust supply chain for biofuel production and distribution.

CASE STUDY UAE

By Yousif Lootah

Typically, renewable energy initiatives in the UAE have focused on solar, wind, nuclear or landfill-to-energy projects. At the transportation sector level, there has been an emphasis on electric cars and on cars powered by compressed natural gas; however, the use and promotion of biofuels has been relatively less discussed or implemented in the region.

Shell's Energy Scenario data estimates that demand for diesel is increasing at an average 4 per cent per annum led by a growth in the cargo business, underlined by the UAE's status as a global logistics hub.

The growing demand for and use of traditional fuels also create a large carbon footprint. According to the IPCC 2007 report, the transport sector accounts for 13 per cent of all greenhouse gas emissions.

The UAE is leading the way and setting a model in this regard through biofuels derived from used cooking oil. A highly cost-effective raw material for biodiesel production, recycling cooking oil for use as automotive fuel can significantly cut down greenhouse gas emissions.

According to the biodiesel standards set up by the Worldwide Fuel Charter Committee, EN 590 and ASTM D975 fuel specifications for petroleum-based automotive diesel fuel permit a biofuel extender content of up to 5 per cent (B5) of the blend. This is up to 20 per cent in the US in comparison because it represents a good balance of cost, emissions and cold-weather performance, and no engine modification is required up to 20 per cent blend.

Much like traditional, pure diesel, these blends can be used in any application. Engine manufacturers recommend B5 blending as it calls for no modification in the engine or fuel system. This is a great opportunity for governments to encourage mandatory B5 blending, given its long-term advantages.

Dubai and Abu Dhabi have more than 4,000 restaurants that can play a central role in supporting biofuel production. The total capacity for waste cooking oil biofuel production in the UAE is 30000 metric tons per annum (data recorded as per the local market research).

A concerted effort by the government, waste management companies, biofuel producers and fuel companies can create a robust supply chain for biofuel production and distribution.

Led by the 'green vision' of the UAE, this has indeed become a reality, and today, nearly 10 million liters of biodiesel blend B5 are manufactured every year in the country through the initiative by Lootah Biofuels – of which 5 per cent stem from processed cooking oil and the remaining 95 per cent is petroleum diesel obtained from the local market as per the Emirates standards and specifications. This is used to power about 5,000 vehicles, with biofuel consumption set to increase 25 per cent every year. The Roads & Transport Authority (RTA), companies with large fleets and school bus fleets have pilot-tested the biodiesel B5 with positive results.

The biodiesel project has been encouraged by agencies like the Dubai Carbon Centre of Excellence and Abu Dhabi Quality & Conformity Council. However, to drive a strong biofuel initiative, there has to be greater involvement among all stakeholders, including consumers, fuel suppliers and regulators.

Already, the Federal Government has decreed the use of Euro 5 standard diesel. A mandatory blend of B5 will be the next big step in the UAE's Vision 2021 to be among the best nations of the world.

Biofuels are a key part of our renewable energy future. Imagine the transformational impact that we can achieve when all stakeholders join hands to manufacture and consume biodiesel generated from cooking oil that otherwise simply goes to waste. ■

ABOUT YOUSIF AL LOOTAH



He is currently the Executive Director of S.S. Lootah Group and CEO of Lootah Biofuels.

THE PETROL-ELECTRIC HYBRID TAXI: A DUBAI TAXI CORPORATION EXPERIENCE



A DTC PILOT PROGRAMME USING A CAMRY HYBRID TAXI SHOWCASED 28 PER CENT FUEL EFFICIENCY OVER A REGULAR CAMRY

CASE STUDY UAE

By Ahmed Al Suwaidi

DTC Petrol-Electric Hybrid Taxi Pilot Trial

As part of RTA's effort and commitment to the conservation of the environment, Dubai Taxi Corporation in collaboration with Toyota Motor Corporation and its local distributor, Al Futtaim Motors, have launched a pilot trial to test petrol-electric hybrid vehicles for the Taxi Fleet in Dubai.

Purpose of the Pilot Programme

The pilot programme was launched in August 2008 and ended in August 2011, using 10 Toyota Camry Petrol-electric Hybrid vehicles. The pilot programme aimed to:

- Support the Government's initiative to lower greenhouse gas (GHG) emissions related to transportation;
- Determine whether replacing conventional taxi vehicles with petrol-electric hybrids would provide economic benefit to the Corporation while simultaneously benefitting the environment;
- Provide baseline data to determine the reliability and performance of petrol-electric hybrids in the UAE for future use in the private car fleet.

Evaluation Criteria

- Roadworthiness
- Safety
- Comfort
- Reliability
- Maintenance costs
- Fuel economy
- Environment impact
- Purchase price of vehicle

Methodology

The programme consisted of providing taxi drivers with the hybrid vehicles and collecting data throughout the trial period. Ten vehicles were tested during the three year period. Over the course of the pilot programme participants were required to monitor and report fuel consumption and qualitatively monitor maintenance costs and vehicle performance.

Each vehicle had the odometer reading, fuel consumption and repair details were recorded into the computerised system. The major components of the hybrid system included in the trial are the battery pack, the electric motor & generator and the power split device. During the trial, the drivers were also trained to monitor the performance of the vehicle closely. All data and results were analysed.

Results of the pilot trial

- All the test vehicles exceeded 550,000 kilometres
- Hybrid components/systems failure: None
- Major breakdown: None
- Major maintenance item: None
- Difficulty faced in maintenance: None
- Fuel efficiency improvement: 28 per cent
- CO_2 emissions reduction: 28 per cent

Current performance of 20 petrol-electric hybrid taxis in DTC fleet



Toyota Camry Petrol		Toyota Camry Hybrid
11.88 litres per 100Km	**Fuel Efficiency**	8.49 litres per 100Km
82 litres	**Fuel consumed per car per day**	59 litres
196 Kg CO_2	**Volume of CO_2 emissions produced per car per day**	141 kg CO_2
284 g/km	**CO_2 gram/Km**	203 g/km
28 per cent	**Fuel efficiency improvement**	28 per cent
28 per cent	**CO_2 emissions reduction**	28 per cent

Current DTC Plan

Under the current DTC plan, another 50 petrol-electric hybrid vehicles were purchased in addition to the current 20 in the fleet, making a total of 70 petrol-electric hybrid vehicles.

ABOUT AHMED AL SUWAIDI



He is the Chief Executive officer of Dubai Taxi Corporation

Positive Environmental and Fuel Economy Impact if DTC fleet converted to petrol-electric hybrid taxi

BENEFIT IMPACT PER YEAR

Fuel saving **57** million AED

CO_2 emissions reduction **78,734** tonnes

Toyota Camry petrol-electric hybrid battery pack



Key Messages from DTC

The taxi industry is a significant source of greenhouse gases (GHG) emissions and air pollution. Switching to a hybrid vehicle would reduce annual GHG emissions significantly. DTC's experience has shown that CO_2 emissions can be reduced by about 20 tonnes per car per year.

Dubai has one of the world's highest car ownership with a number of 541 cars per 1,000 population. CO_2 emissions affect climate change and are directly related to the amount of fuel used. Therefore, if public transport, commercial and private vehicles adopt alternative fuels like hybrid technology, the carbon footprint can be reduced drastically.

Besides CO_2 emissions reductions, it would also cut annual fuel bills by 28-30 per cent for public transport, commercial and private vehicles.

DTC's experience in operating hybrid vehicles can help convince other taxi companies, commercial entities, private owners and public transport operators to switch to hybrids. ■

HARNESSING 'FREE' ENERGY

INNOVATIVE APPROACH TO POWER GENERATION AND CONSUMPTION IS HELPING THE UAE'S ALUMINIUM INDUSTRY GO GREEN



COMMENTARY

By Tayeb Al Awadhi

As an active member entity of the Dubai Supreme Council of Energy ("DSCE"), Dubai Aluminium PJSC ("DUBAL") whole-heartedly supports the implementation of the Dubai Integrated Energy Strategy ("DIES") 2030 in terms of efficient energy generation and use. This will help meet the DIES 2030 demand reduction, environmental and sustainability objectives. DUBAL has allocated significant budget to deliver a number of projects to optimise energy consumption while enhancing environmental performance. Two particularly innovative projects implemented recently are set out below.

> "The PV solar power generation plant will mitigate approximately 80 tonnes of carbon dioxide emissions per year."

Capturing solar power

In order to expand the use of renewable sources of energy, as directed by the DSCE, DUBAL has built a solar power generation plant. This mainly serves the Residential Area Management Building at its Jebel Ali site. The plant uses photovoltaic ("PV") energy technology, and reduces fossil fuel energy consumption.

The grid-connected PV system was provided by Sunpower (USA), with Inverters and other system components from Europe. It is capable of generating approximately 90KWp. The PV solar power generation plant began producing green energy in mid-2014, and will mitigate approximately 80 tonnes of carbon dioxide emissions per year.



Using steam-heat to deliver cool air

In order to maximise energy utilisation and reduce auxiliary power use, a small volume of the steam produced by the DUBAL captive cogeneration and combined cycle power plant is used to power the UAE's first-ever waste heat-based absorption chiller. This is the first such application in a power plant.

Built on the rooftop of DUBAL's Desalination Plant Control Building, the absorption chiller has assumed the functions formerly fulfilled by the electricity-driven vapour compression air-conditioning chillers used for comfort cooling of the building. The absorption chiller process uses just 40 per cent of the electricity consumed by the conventional electrically-driven chillers and uses a nominal 0.6 tonnes of steam per hour to produce sufficient cooling for the same purpose.

> "The absorption chiller process uses just 40 per cent of the electricity consumed by conventional electrically-driven chillers."



Absorption chiller technology also provides a wide range of other benefits – it utilises waste heat energy (e.g. steam); it does not use CFCs or HCFCs since water serves as the refrigerant; operating and maintenance costs are low; there is no dynamic load, no vibration and no noise; and it is highly reliable and effective in high ambient temperatures.

DUBAL's absorption chiller has the capacity to reduce DUBAL's annual energy consumption by approximately 626,800 kWh.

In summation, the pilot project has successfully demonstrated that the absorption chiller technology has the ability to save energy and protect the environment. There is also hope that going forward this concept could be used for other applications where energy-efficient cooling is required – such as equipment cooling. ■

ABOUT TAYEB AL AWADHI



As the Vice President: Power & Desalination at Dubai Aluminium PJSC ("DUBAL"), Tayeb strives to improve the availability, reliability and efficiency of the DUBAL's Power Plant while optimising operating costs and minimising the plant's environmental impact. He holds an MSc (Engineering Science) from University College, Dublin.

WASTE RE-VISITED

MODERN APPROACHES TO TREAT WASTE CAN SIGNIFICANTLY REDUCE WASTE MANAGEMENT COSTS

CASE STUDY UAE

By Martti Surakka

Efficient waste management is essential in modern urban societies. Space limitations and pollution concerns render traditional landfill disposal un-sustainable or un-acceptable. Incineration is the established alternative.

Historically, all waste was burned in the same incinerator – mass incineration – as an efficient way to destroy waste. However, lots of energy is exhausted on heating non-burnable waste or evaporating water from humid waste and precious recyclable materials are destroyed. There are thus clear opportunities for more efficient ways to dispose waste and improve incineration efficiency.

> If organic and inert matter is removed, the calorific value will increase and the amount of waste going to the incinerator will be reduced by 55 per cent.



> If the organic fraction and other non-combustible materials were removed, the total amount of waste in Dubai would be reduced by 42 per cent to 1.56 million tonnes.

Reasonable levels of source-separation increase efficiency and create value

One approach to improving efficiency is source-separation. The composition of industrial waste is usually well-known and some waste components represent high value raw materials for other processes. In municipal solid waste (MSW), the biodegradable and non-burnable components, e.g. sand and stones, are reused, e.g. for construction or landscaping.

With household waste, the situation is different: it contains practically everything. Efficient utilization requires sorting into tens of different bins, rendering source-separation practically impossible. Where source-separation is used it usually applies to "easy" components such as metals, glass, and paper.

Separation and sorting continue at the waste sorting plant, the starting point of any modern waste treatment facility. These facilities contain sophisticated industrial processes with a variety of functions – they are in effect waste refineries.

When waste is refined, the generated refuse derived fuel (RDF) has alternative uses. RDF is a tradable commodity that can replace other fuels in industrial processes. The principle of the RDF market in the EU is to utilise the waste at the lowest possible cost.

Case UAE: Efficient waste refining can make the UAE's incinerators more energy efficient

In the UAE, there are several ambitious projects and plans to achieve zero-waste target; i.e. all generated waste would be utilised. For example, Bee'ah has started a waste management centre in Sharjah where part of the organic matter is composted and used in farming or for soil products.

In Dubai, the organic waste content has a very low heating value (see Table 2). It represents a large share of total waste and incinerating it is very costly. Under envisaged plans, the organic fraction would be taken for composting.

Removing the organic fraction and other non-combustible materials would reduce the total amount of waste in Dubai by 42 per cent to 1.56 million tonnes. The heating value of the remaining waste would rise by 37 per cent to 12.4 MJ/kg[1]. Reducing the amount to be incinerated by such a high percentage would mean the required boiler investment - the costliest component - reduces and significant efficiencies and economic benefits are achievable.

In Abu Dhabi (see Table 1) the amount of organic material is higher than in Dubai. This means the overall fuel quality is even lower. If organic and inert matter were removed, the calorific value would increase and the amount of waste going to the incinerator would reduce by 55 per cent[2].

The incineration facility currently planned by TAQA is designed for the existing levels of waste. Even short-term growth in waste volume would require additional investment, unless applying sorting before incineration. This could double the effective capacity and cover future needs for the next 15-20 years.

A key question for the UAE to consider is whether RDF should be incinerated domestically. As the RDF market is global and developing rapidly, it might be more profitable for the UAE to ship the produced RDF to countries with high demand for RDF.

Table 1:
The composition of Abu Dhabi's waste in 2009:
Total of **1,272,668** tons

23.00% Paper	**19.00%** Plastics	**40.00%** Organic	
3.00% Textiles	**8.00%** Inert	**4.00%** Metal	
	3.00% Glass		

100.00% Total / avg.

45% Organics and non-combustibles removed

Source: Waste Statistics in the Emirate of Abu Dhabi, February 2011

Table 2:
The composition of Dubai's waste in 2009:
total of **2,689,808** tons

24.29% Paper	**24.24%** Plastics	**35.43%** Organic	
3.19% Textiles	**1.09%** Rubber	**0.98%** Wood	
0.60% Leather	**1.93%** Inert	**2.45%** Spec+Misc	
2.37% Metal	**3.43%** Glass		

100.00% Total / avg.

63% Organics and non-combustibles removed

Source: 2011 Annual Congress: 3rd e-Health Conference in the Middle East

Road ahead for the UAE: realising the benefits of more efficient waste management

The UAE has ambitious plans to stop landfill and start recycling waste streams efficiently. This is a development to be encouraged. The most important projects are located in Abu Dhabi, Dubai and Sharjah, but the goal should be the same in all Emirates.

More efficient waste recycling benefits the environment, improves the quality of everyday life and produces savings in waste management costs. Composting or digesting the organic fractions can provide farmers with much-needed humus, nutrients and irrigation water. Sorting and guiding the waste fractions to their best reasonable use will reduce the investment costs of the waste facilities substantially.

We support these developments and look forward to seeing the project owners challenged to embrace the best available solutions and adapt them to the UAE conditions. ■

FOOTNOTES

1-2 Calculation based on data from 2011 Annual Congress: 3rd e-Health Conference in the Middle East

ABOUT MARTTI SURAKKA



Martti joined Pöyry Management Consulting's energy division in 2007. He has more than 20 years' experience in consulting, industrial service and engineering in various positions.

04

GREEN & EFFICIENT CITIES

HIS EXCELLENCY
SAEED MOHAMMED AL TAYER

MANAGING DIRECTOR AND CHIEF EXECUTIVE OFFICER OF THE DUBAI ELECTRICTY AND WATER AUTHORITY (DEWA)



In June 2013, the Dubai Supreme Council of Energy announced the Energy Demand Side Management (DSM) Strategy that complies with the fundamentals of the UAE National Agenda, including the Green Economy for Sustainable Development initiative and the UAE Vision 2021. Today, the Supreme Council of Energy is considering the formation of an agency for energy efficiency to manage energy projects in Dubai.

The DSM Strategy is based on 8 programmes including Green building specifications and regulations, retrofitting of buildings, district cooling, wastewater reuse for irrigation, standards and labels for appliances and equipment, and lighting systems. The strategy introduces mechanisms that are aligned with international best practices implemented worldwide. The mechanisms include capacity-building, promoting public awareness, adequate policy and regulatory framework, information systems, and financing mechanisms specifically adapted for Dubai.

The Supreme Council of Energy has also encouraged the Energy Services Companies (ESCO) market in the Emirate to promote demand reduction. The Council launched Etihad Energy Service Company to provide energy efficiency solutions to implement demand management and reduction mechanisms, which can be achieved in cooperation with partners through financial, technical, and performance guarantees to further establish Dubai as a global energy efficiency hub and create a better business environment.

ENERGY EFFICIENCY IN THE UAE



MAIN REPORT

By Dr. Nawal Al-Hosany

Challenge and Opportunity

As the United Arab Emirates (UAE) looks to diversify its economy, it does so with an appreciation of the need to ensure this happens on a sustainable footing. Energy efficiency is certainly part of this picture and is increasingly being placed at the heart of urban planning and the built environment. With UAE being a leading oil producing nation, there is also a clear understanding of the need to make best use of this precious resource. In doing so, our country is attempting a pivot of historic proportions.

The rising premium on the value of oil, the UAE's status as a net importer of gas, the cost of diversifying energy supply more broadly and the ever increasing demands for energy are driving change. These dynamics stand strong on their own merit, even before climate change is factored into the equation. The most cost effective, cleanest and efficient power plant is after all the one you don't have to build in the first place. The economic opportunity on offer is also compelling. Why stop at implementing best practice, when we can also be innovating, developing and commercializing the next generation of energy efficiency technologies and services ourselves. This is certainly a bold vision, but one in which progress is being achieved.

The importance of managing the UAE's energy demand in a more proactive way is now clearly recognized by practitioners, specialists and policy makers. Over the past decade, the pace of change has become more tangible. Whether enshrined in government policy or visible in practical innovation on the ground, energy efficiency and sustainability have put down roots in the UAE over the last decade. At the same time, however, a range of factors, by-products of our startling growth as a nation – rising population, increasing consumption and rapid economic growth – are pushing back in the other direction.

Energy demand, for instance, is predicted to double by 2020. Whilst the emissions per capita have been falling steadily over the last decade, the overall carbon footprint continues to grow in absolute terms, in line with population growth just under 3 percent per year. Admittedly, this is a situation by no means unique to the UAE, yet a burgeoning population and the challenging climatic conditions in the UAE underline the scale of the challenge. This should not detract from progress made, but rather should focus minds on the need to push forward with the bold vision and drive for which we are known.

> "The clear legacy of conservation established by the late HH Sheikh Zayed bin Sultan Al Nahyan is evident in the energy efficiency policy and projects in place today."

Change in Practice

The clear legacy of conservation established by HH Sheikh Zayed bin Sultan Al Nahyan is evident in the energy efficiency policy and projects in place today. A wide range of initiatives support, what is effectively, a national effort to establish a more sustainable future. Each project helps contribute to the bigger picture while remaining fairly distinct in its own right. The UAE is, in this sense, looking to address energy efficiency as much from the bottom-up as the top-down. It is worth looking at a few of the ways this is being achieved today to understand how the energy efficiency agenda is taking shape across the built environment.

The Estidama, Pearl Rating System for sustainable construction has arguably been the most transformative measure in place. Estidama, which means 'sustainability' in Arabic, looks to create more sustainable communities and cities based on the four pillars of sustainability: environmental, economic, cultural and social. Implemented four years ago by Abu Dhabi's Urban Planning Council (UPC), it is the first programme of its kind tailored to the Middle East. As a mandatory measure for all new construction in Abu Dhabi (in contrast to similar schemes such as LEED or BREAM), it stands front and center of the UAE's drive to ensure new building stock is markedly more sustainable and energy efficient. After all, it seeks to rapidly change the energy efficiency performance of the built environment across Abu Dhabi.

Along with the Estidama program, demand side management in energy consumption is a key aspect of the Plan Abu Dhabi 2030 drive to shape the future of the city according to innovative green standards. One way that this is being pursued is through the demand side energy efficiency programme developed during 2010 to 2011, which seeks to minimise the carbon footprint of existing buildings across the city. Adopting a multi-sector approach to achieve an overall reduction in energy consumption, it aims to improve energy efficiency in buildings across the city while also raising awareness and supporting behavior change amongst residents. As part of the programme in March 2011, Masdar, in partnership with Abu Dhabi Municipality, came together to put the vision into practice.



Masdar, with its strategic partner Schneider Electric, undertook a detailed energy audit and analysis of conservation measures for 70 buildings in the city center. This involved significant research and analysis. Energy bills, architectural drawings and building specifications were all analyzed. Data was gathered using electrical equipment and combined with information on broader energy consumption and weather patterns. Surveys were conducted with residents and supplemented by field visits to apartments to form an accurate picture of behavioral trends. The result was a very comprehensive evidence base to support analysis and, ultimately, recommendations for change. Completed at the end of 2012, the outcome of the project was a long list of energy conservation measures, offering reduced utility bills and lower building operating and maintenance costs. These options are now being progressed with a view of implementation.

Demand side energy conservation programmes can in this way increase the energy performance of buildings, by improving the way people and buildings draw down and use energy. Another significant opportunity can be found in more effectively managing and optimizing the peaks and troughs in power supply through demand side response. This entails better managing the supply of energy over the short-term, through the use of smarter infrastructure and energy management devices which are more responsive and flexible than has traditionally been the case. It is an approach that can provide highly significant returns from an energy efficiency perspective. Across the power supply, transmission and distribution system, any reduction in peak load (when demand for power is at its highest) is valuable in minimizing additional investment needed in both new generation capacity or the power network itself. A host of exciting technologies and approaches means there is an ever increasing range of opportunities to put demand side response into action. In their own way, they offer better control of energy supply without noticeably affecting the end user. This can be as simple as cooling buildings at a time when demand for energy is at its lowest.

A range of new demand-side technologies and strategies is currently being explored by a multi-entity taskforce, involving Masdar Institute and coordinated by the Executive Affairs Authority of Abu Dhabi. As part of a broad programme, this includes initiatives such as the modelling and simulation of energy use in buildings and cities, to developing an optimal control strategy for district cooling plants and looking at demand response and adaptive energy generation for smart grids. With smart grids expected to play such an important role in unlocking both demand side response and options for energy management, it is encouraging to see Dubai leading the way in terms of their actual roll-out. A total of one million smart meters are to be installed in apartments and villas across the emirate over the next five years by the Dubai Electricity and Water Authority (DEWA), with an impressive 100,000 already in place.

Looking to the future, it is realistic to expect both demand side management and response initiatives to be working in tandem and rolled-out across the entire UAE. The next generation of technologies is expected to provide smart home and building energy management systems. This will enable end-users to participate actively in the process in a way which works best for them, while also making it easier to manage energy supply at a national level.





Masdar City is also a highly critical initiative in demonstrating what is achievable today by adopting a ground-up approach to sustainable development. With passive energy design at the heart of the project, residual energy demand is minimised from the very beginning of any development. Smart design is evident throughout the city, which has been planned to maximise convenience and reduce environmental impacts. Its streets are shaded all day long while capturing cooling breezes, reducing the need for air conditioning. A mix of educational, recreational, housing, retail and office space allows commuters and residents to find everything they need close at hand to reduce transport needs. High-efficiency appliances in turn help minimise unavoidable energy use. In short, every angle has been considered. The city also provides a test-bed or living laboratory in which students from Masdar Institute, resident companies and Masdar project teams can work collaboratively to research, develop and apply new technologies.

Another example of bold innovation comes with the work in Dubai to support energy efficiency by developing a market based framework approach to energy efficiency savings. The Etihad ESCO (Energy Service Company), is a Dubai Electricity and Water Authority venture established in 2013. As a 'super ESCO', it is putting in place the foundations for an energy performance contracting market in Dubai, by developing energy efficiency projects targeting more than 30,000 buildings. At such a scale, it promises to jumpstart the creation of a performance contracting market for energy services. This will be achieved by delivering building retrofits and increasing the penetration of district cooling, while also building capacity and providing market entry opportunities and access to project finance for other local ESCOs. In doing so, the Dubai ESCOs market will provide new business opportunities for joint ventures and international partnerships, as well as involve UAE national entrepreneurs through a diversified supply chain.

This is all part of broader activity in place across Dubai which will help contribute to achieving energy demand reduction targets set by Dubai Supreme Council of Energy in the Dubai Integrated Energy Strategy 2030. Working to a 20 percent demand reduction for 2020 and 30 percent for 2030 respectively, the vision is again bold, yet so too are the measures being put in place to achieve it. Looking forward, the forthcoming international Dubai Expo in 2020 will be a point at which the UAE will be able share the sustainability milestones achieved with an international audience. The expo itself will in turn embody the progress being made in enhancing energy efficiency, as one of the most sustainable in the history of World Expo events.

Looking to the Future

The few examples highlighted above demonstrate how committed the UAE is to transform the way we use and conserve energy. Yet, with energy demand increasing by 10 percent per annum, the challenge still stands. The variety of initiatives underway is a key strength in meeting it, providing a clear opportunity to ensure they are more than the sum of their parts. This is being realized as we join the dots; share learnings, build on cooperation and continue to scale-up activity. In this way, our intent could not be clearer, and we are delivering on our ambition. While we still have a lot to achieve, I look forward to celebrating another UAE success story in attaining what many others would simply consider out of reach. ■

ABOUT DR. NAWAL AL-HOSANY



She is the Director of Sustainability in Masdar. Dr. Al-Hosany leads Masdar's sustainability team and is director of the Zayed Future Energy prize.



INTERVIEW

INTERVIEW:

SAEED AL ABBAR

Chairman of Emirates Green Building Council

What makes a city green, Mr. Al Abbar?

One of the key areas of focus in the move towards a green economy lies in shifting the way in which urban areas develop. How can the UAE guide sustainable urbanisation within its cities?

Saeed Al Abbar: The approach to sustainable urbanisation starts with constructing energy- and water-efficient buildings and neighbourhoods. The UAE is currently on track with its focus on sustainable urban environments, with hundreds of projects being developed in conformity with local and international sustainable construction criteria such as Estidama, LEED, and the Dubai Green Building Code.

New developments, such as the 120-acre Sustainable City, serve as urban labs in the move towards a greener future. Dubai has emphasised the importance it places on sustainable growth with one of the core themes of Expo 2020 being sustainability.

The UAE is also focusing on transit-oriented developments (TOD), which enhance mobility between residential and commercial sectors and have a long-term beneficial impact on the environment. The launch of the Dubai Metro has had a significant impact on urban sustainability and the Roads & Transport Authority (RTA) is finalising a tram system in Dubai Marina which will help promote accessibility and mobility.

A green economy is enabled when the commercial and financial sector is focused on producing, importing, exporting and re-exporting green technologies and products. From an urban development perspective, this translates to obtaining and prioritising sustainable products for the construction, development and retrofitting of new and existing buildings.

Regulatory support by local authorities further contributes to educating the market on the importance of integrating sustainability considerations into projects.

What role can Expo 2020 play to create sustainable urban environments in the UAE?

Saeed Al Abbar: The Expo 2020 integrates sustainable development considerations into the infrastructure and operations of the event. This covers everything from design and planning of the Expo site to conducting the global event.

A focus on reduced energy and water use, production of on-site renewable energy and promoting awareness across all Expo 2020-related construction and development will be significant drivers.

In addition, supply-side management approaches, such as taking full advantage of new and emerging sustainable technologies that can offset resource demand, must also be considered.

It is also important to continuously educate the market that building green is no more expensive than regular construction materials and systems, with greater long-term benefits.

> New developments, such as the 120-acre Sustainable City, serve as urban labs in the move towards a greener future

How would you define a 'green city'?

Saeed Al Abbar: A green city has leaders who are committed to building a sustainable environment, along with inhabitants who are knowledgeable and cooperative with the ethos of environmental consciousness and responsible living.

Led by clear policies and guidelines, a green city knows its limitations and potential and channels its resources and wealth accordingly, by enacting policies that ensure environmental protection. A green city meets its energy and water needs from renewable sources, which are managed effectively, in addition to focusing on demand-side management to avoid excess usage.

Formulating regulations that act as barriers to inefficient and unsustainable practices will be key to the long-term operations of a green city.

What role can an integrated approach between players (public, private, academic entities) play in establishing green cities?

Saeed Al Abbar: The three sectors – public, private and academic – must work hand in hand to achieve environmental goals. The UAE is already on that path, as demonstrated by Mubadala's Masdar initiative. While Masdar Institute of Technology (MIST) undertakes green research, Masdar Capital provides the necessary funds to turn the research into actionable technology, which is applied at Masdar City, which aims to be the one of the most sustainable cities in the world.

Sheikh Mohammed bin Rashid Al Maktoum Solar Park is another example of a partnership between the government, through the Dubai Supreme Council of Energy and Dubai Electricity & Water Authority, and private sector stakeholders.

As a voluntary entity, EmiratesGBC plays a strong role in integrating the functions of key stakeholders through strategic partnerships. We have established several MoUs with academia, government and private entities to further advance our mission of a greener UAE. The regular monthly workshops, networking events, and our Annual Congress ensure that members and industry partners have a strong platform of engagement, education and collaboration to spearhead the growing green market in the UAE.

The UAE (Dubai in focus) is currently committed to introducing new integrated 'smart' technologies in order to deliver the benefits of the green economy. What are these technologies and how can they work together to empower government bodies and residents?

Saeed Al Abbar: District cooling technology reduces energy and water consumption while increasing efficiency. New technologies include the in-house treatment of sewage through reverse osmosis, and chiller systems which reduce potable water use and operational costs by utilising recycled waste water.

Another initiative is waste-to-energy, with several private firms working with Dubai Municipality to reuse methane from sewage treatment plants and convert it to natural gas. Metering and sub-metering to measure energy and water consumption of buildings and help label their performance, under building labelling or benchmarking frameworks, is another strategic direction. The Smart Dubai initiative will also help centralise government functions, making electronic billing and paperwork systematic, and reducing paper usage and wastage.

In other models, demand-side management usually aims to charge the consumer based on the true price of utilities, encouraging consumer behaviour to suit public policy. How can DSM truly benefit the UAE, considering subsidies and allowances?

Saeed Al Abbar: One of the primary and most effective ways the UAE government can manage demand is by bolstering the Energy Performance Contracting market. Operations have already begun in Dubai and, with its likely success, other Emirates will follow suit. The potential in energy and water savings through EPC are expected to be around 19 terawatt/hour and 47 billion imperial gallons, respectively, by 2030. It should also be noted that utility tariffs in Dubai are comparable to other developed countries and there is already a strong economic justification for reducing utility consumption. Sustained customer awareness campaigns are crucial, as they have the most important role in DSM. Realising the true value of what is received will encourage customers to minimise wastage.

Finally, demand-side management is integrally linked with green buildings, and those which have a strict energy- and water-efficiency protocol will contribute to energy, water and financial savings. It will also reduce the pressure on the authorities, encouraging them to set aside additional funds for other beneficial projects such as schools, hospitals or renewable energy plants. ■

FACT BOX

EMIRATESGBC'S TECHNICAL GUIDELINES FOR GREENING EXISTING BUILDINGS

The Technical Guidelines for Existing Buildings have been written and compiled by Emirates Green Building Council (EmiratesGBC) and its industry partners to complement existing regulations and green-building rating systems in the UAE.

The guidelines actualise HH Sheikh Mohammed Bin Rashid Al Maktoum's 2007 Decree which authorised green building standards for all urban structures, and align effectively with Dubai Municipality's Green Building Code and Abu Dhabi's Estidama.

The guidelines provide a collection of methods to equip existing building owners with the necessary tools they can deploy to target or offset minor and major sources of environmental pollution emitted by most buildings in operation in the UAE.

The solutions provided enable immediate and long-term reductions and efficiency in energy and water use; improvements in indoor air quality; and effective waste management, with subsequent lowering of utility and labour costs for building owners.

Retrofit technology exists for every building operation sector and the guidelines cover a comprehensive range of topics including lighting efficiency, energy-management systems, no-cost measures, thermal insulation, condensate recovery, greywater systems, submetering, air quality testing and landscape irrigation.

Building owners are updated on the most sustainable methods and technologies available in the UAE's growing green market.

The EmiratesGBC Technical Guidelines will be available at the end of 2014. ■

DEMAND SIDE RESPONSE FOR THE UAE

COMMENTARY

By Joni Tefke

> DSR strategies are either pushed by regulators or market participants



A PLEDGE FOR A REGULATORY BUSINESS FRAMEWORK AND OPEN-MARKET STRUCTURES

In the UAE, the Emirates of Abu Dhabi and Dubai have initiated Demand Side Management (DSM) and energy-efficiency campaigns to curtail an increase in demand triggered by high levels of projected economic and population growth. As part of DSM, measures can be implemented under which different consumer classes reduce their demand at particular times when given a signal to do so. These are called Demand Side Response (DSR) measures. DSR can play a key role in reducing the generation infrastructure investments required to meet peak demand as well as in optimising how the UAE power systems operate. For UAE consumers, the key benefits of DSR are reduced energy costs (or sustainability of low prices) as well as secure system operations, i.e. reduction of outage risks.

In the development of DSR strategies, two areas need to be addressed:

- How is the DSR ecosystem created; and
- How can comprehensive participation by all relevant stakeholders be established?

Both aspects are interlinked – the first seeks to develop the most efficient structure, with the second ensuring the right group of participants in the DSR eco-system.

Creating DSR Systems

DSR systems are complex: numerous connected layers are required to function in unison (see figure below). Due to various conflicting objectives and priorities across these layers, the system is hard to control centrally and its behaviour is not easily predictable.

DSR strategies are either pushed by regulators or market participants. Regulation-driven approaches generally lead to a faster set up of DSR systems than market-driven approaches. However, market control through tight regulation may hinder innovation and market development. Market-based approaches on the other hand may gradually lead to fragmentation and a range of incompatible approaches, where suppliers are trying to lock participants in to their services and technologies. An ideal setup combines the best of both approaches – a regulator creates the business framework and open market structures, whereas commercial players are responsible for business model innovation and development of solutions.



Attracting the Right Stakeholders

The value of DSR systems grows exponentially as the numbers of applications, industries, participants and controllable loads increase. Therefore, it is essential to secure participation of relevant stakeholders, which in turn is key to delivering sufficient returns on investment and generating the desired impact on the power system. The value is further increased by including additional energy categories – such as water, gas, heat, cooling and transportation – given the linkages between these – to create a comprehensive smart city ecosystem that delivers the greatest possible benefits.

Overcoming Barriers to Successful DSR

Based on our experience across a wide range of industries, DSR has had to overcome a number of barriers including:

- Limited knowledge and experience of DSR. Typical questions include what is the market mechanism, how to participate, what is needed, and what benefits can be expected? Lack of knowledge may mean there are no obvious incentives to reengineer the processes for intermittent energy supply. If a company's energy strategy and management incentives were designed well before the smart and renewable energy era, this may also discourage its active participation in DSR markets.
- Unclear business models and regulatory framework. Developing the DSR market requires a visible working business model, well-defined market roles and a stable regulatory framework. The most common reason for not participating in DSR has been the low level of financial reward and its negative impact on the development of mature market structures.
- Small and fragmented loads require aggregator services. In most cases the largest contributor to the DSR system is substantially small, i.e. its own demand is only a fraction of the total system demand. Only a few industries have high enough energy consumption to participate in DSR markets, for example aluminium producers, steel works, wood and paper processing industries and cement producers. To have impact, DSR coverage should reach a wide range of industries and participants.

Data Hubs to Enable Successful DSR

DSR schemes are being complemented by building data hubs which provide a centralised platform for energy-market information exchange. Data hubs help the implementation of market reforms and the enforcement of new structures by simplifying market processes, storing and collecting consumption, customer and contract information and making it readily available to businesses providing DSR services.

Currently, DSR-linked data hubs are being implemented in a number of countries, including Denmark, the Netherlands, the USA and Canada. Information on potential controllable loads is collected and DSR providers can utilise that information in designing aggregation services. The development of data hubs has recently shifted towards real-time processes creating an ideal platform for DSR, electric vehicles and grid control. In those designs, control commands are forward to DSR-capable equipment by the data hub or the whole DSR system is managed by the data hub.

To support DSR implementation, data hubs:

- Require technology-neutral, open and standardised market processes and interfaces for DSR service companies and participants
- Should contain information on controllable loads, DSR pricing and energy imbalances
- Clarify market roles and promote energy-market development by allowing regulators a natural step to upgrade market structure and mechanisms
- Create platforms supporting market-based service innovation allowing an increasing amount of real-time services and gradual integration of smart energy and smart city initiatives in the future
- Help grid companies to plan their operations and investments. Data-hub rules and DSR pricing should guide the use of energy based on grid-company needs.

Application of the Data Hub Idea in the UAE

Dubai is implementing its DSM strategy with DSR being one of the eight key elements of the strategy. As part of its smart city vision, Dubai is already planning the development of a data hub. Abu Dhabi is also tackling DSM and DSR, and is reviewing options for a separate night-time electricity tariff.

Based on international experience we suggest the following steps in implementing a data hub infrastructure in the UAE:

FOOTNOTES

To address the complex and fragmented nature of DSR, the UAE should adopt an integrated approach combining regulatory and market forces. The UAE regulators should be tasked to build an open DSR platform, while service development is best done by market participants (potentially in cooperation with ADWEA and DEWA). In this regard, it is key for the UAE to develop a DSR framework that provides sufficient information by using data hubs to allow market participants to develop workable business models for DSR participation.

1. Vision and concepts
- Recognised market problems and DSR needs
- Vision and targets: energy consumption reduction, grid and generation
- Links to other smart city and smart energy concepts
- Input from energy, industry and other major DSR participants
- Feasability studies of DSR and data hubs
- Mandate for market and data hub development

2. Business and market process design
- New regulatory framework and required changes in legislation
- Understanding of energy market related business processes
- Understanding of end-user processes
- Design of market processes for DSR services and data hubs
- Definition of new market roles, e.g. DSR providers and data hub operators
- Pilot system

3. Functionalities and technical requirements
- Required functionalities for DSR system and data hubs
- Business and technical requirements
- Implementation plan for DSR and data hubs incl. Systems phasing
- Competitive procurement process
- Supplier selection

4. Solution implementation and testing
- Implementation of DSR and data hub solutions
- Establishing DSR data hub operators, launch of operations
- Extensive testing of the systems
- Establishing a test environment for market parties
- Demonstration system for DSR and data hubs

5. Data migration, trials and commissioning
- Data migration and wash-ups
- Certification of market parties' systems
- Readiness and integration tests
- End-to-end market trials with all relevant parties
- Go Live
- Aditional functionalities in the next versions of data hubs ■

ABOUT JONI TEFKE



He works as a Principal at Pöyry Management Consulting. He is specialised in strategic planning and finance, business planning and modelling, techno-economic analyses and sourcing

TURNING ONE

THE PROGRESS OF DUBAI'S SUPER ESCO SINCE ESTABLISHMENT IN 2013

COMMENTARY

By Stephane Le Gentil



Etihad Energy Services, Dubai's official Super ESCO, has made significant progress over the course of the past year, firmly establishing itself as an accountable entity tasked with creating a viable ESCO market in the emirate of Dubai.

As part of the Dubai Energy Strategy 2030, which aims to decrease energy consumption in the emirate by 30%, the Green Economy for Sustainable Development initiative launched by H.H. Sheikh Mohammed bin Rashid Al-Maktoum provides the Etihad ESCO with regulatory authority support and a mandate to create an ESCO market. More recently, in April, the Dubai Supreme Council of Energy and the World Bank provided Etihad ESCO with access to a green fund for energy efficiency.

Following the Super ESCO's establishment in July 2013, Etihad ESCO has successfully commenced company activity, recruiting its core team of professionals and attracting the best expertise to the UAE market.

In the first quarter of 2014, the Super ESCO held an ESCO market launch, releasing the ESCO framework and the first two Energy Performance Contracting (EPC) tenders to existing ESCOs. In the same year, the focus shifted from operational set-up to signing its first agreements, commencing with an agreement with Dubai's Electricity and Water Authority (DEWA) to retrofit their existing buildings. This was followed by an agreement with the Jebel Ali Free Zone (JAFZA) to retrofit 120 buildings, making it the first free zone in the region to undertake such large-scale steps towards energy conservation and operational cost reduction. The most recent engagement is an agreement with the Dubai International Financial Centre (DIFC) to undertake a 15-building retrofit to enhance the financial hub's energy-efficiency efforts in line with the Dubai Integrated Energy Strategy 2030.

In its role as a market maker and an intermediary between the existing ESCOs in the Emirate, Etihad ESCO has embarked on a number of initiatives to inform ESCOs and other stakeholders about the current operating framework. The Super ESCO has organised a financial workshop with 20 leading financial institutions and banks to introduce a funding framework for ESCOs. The company has also been introducing existing ESCOs for official accreditation by the Dubai Regulatory and Supervisory Bureau for Energy and Water (RSB), with four already certified and a number in the pipeline awaiting accreditation. Additionally, the Super ESCO held the first ever Measurement and Verification training seminar, which led to the certification of 17 Measurement and Verification Professionals (CMVPs). New sessions will be organised in November 2014 to ensure that existing ESCOs continue to receive the necessary support.

Moving forward, a number of Government entities have shown interest in the Etihad ESCO model and are expected to sign up with the Super ESCO to initiate a retrofit plan of their existing buildings. The Super ESCO's operational expectations are being met, with plans and new projects in the pipeline. ■

ABOUT STEPHANE LE GENTIL



He is the Chief Executive Officer of Etihad ESCO. Previously, Stephane was Chairman of the European Association of Energy Service Companies.

REFERENCE CHECK

INTRODUCING THE DUBAI ESCO ACCREDITATION SCHEME

COMMENTARY

By James Grinnell

In 2013, the RSB Dubai developed and outlined a framework designed to encourage Dubai's nascent ESCO market to grow to meet its full potential. That framework was launched in February this year, complete with an accreditation scheme for ESCOs, standard contracts, and a tailored measurement and verification protocol, all of which have been made freely available to download from the RSB website.

Four companies have been accredited in the scheme's first few months of operation – MAF Dalkia, EMS, and Johnson Controls have achieved full accreditation and Al Arsh Facilities Management has been provisionally accredited. Provisional accreditation gives new entrants a chance to gain a foothold in the ESCO market. Others have applied but not been able to meet the scheme's stringent standards, which serve to raise the bar in the ESCO market, testing the applicant's financial strength, experience and technical capabilities.

The accreditation scheme and Dubai's wider ESCO market is generating interest from local and foreign ESCOs, facility managers and related product and service providers. We have already seen a number of companies establish a new presence in Dubai, whether through a subsidiary or joint venture. New entrants have added energy services to their existing capability, such as Etisalat's move into the market with EMS in their Mabanina joint venture.

Facility Management firms are being encouraged to enter the market. Their trade association, MEFMA, sponsored a study which suggested AED7.5 billion in energy savings could be made across the UAE, with 65% energy savings achievable in typical tower buildings. Interest in the accreditation scheme from FM firms supports the view that there are significant opportunities in this area.

Capacity building is an essential element in creating a vibrant, successful market and here, too, the response has so far been encouraging. Some of the international players have strengthened their local capability, bringing in experienced staff from Europe, the US and elsewhere. They, and others, have also raised the skills of local staff, putting them through internationally-recognised training in energy management and, crucially, the measurement and verification of energy savings.



All the indications point to an ESCO market with growing capacity delivering energy savings to both the public and private sector. What next? Well, the RSB is working on an audit and energy performance disclosure regime for Dubai.

In many other jurisdictions, audit regimes have been developed to require an assessment of potential energy savings. These provide the initial basis for viable retrofit projects. In the UK, the adoption of just such a regime has been estimated to have a net benefit of AED12 billion from 2015 to 2030.

Performance disclosure has been used to improve transparency of the energy costs associated with building occupancy, allowing buyers and tenants to make more informed real estate decisions. In Europe, where an energy performance certificate system has been in place for some years, the European Commission has reported: "The analysis of property transactions and listings from residential property markets in Austria, Belgium, France, Ireland and the UK, both sales and lettings, overwhelmingly points to energy efficiency being rewarded by the market." ■

ABOUT JAMES GRINNELL



He is the Head of Water at the Regulatory Supervisory Bureau and has over twenty years of experience in Asset Management and Utility regulation.

MANAGING DEMAND THROUGH EDUCATION

STUDIES GIVE KEY INSIGHTS INTO RESIDENTIAL WATER AND ELECTRICITY USE IN ABU DHABI



CASE STUDY UAE

By Ramiz Alaileh and Khadija Bin Braik

As Abu Dhabi's population and economic base grows, the demand for water and electricity is increasing rapidly. Peak demand for electricity has more than doubled over the last 10 years, with 2013 seeing peak demand of around 8,874MW, and is expected to double by 2020, putting tremendous pressure on the electricity grid.

Likewise, Abu Dhabi's water supply reached 744 million gallons per day (MGD) (3.38 million cubic metres per day) in 2013, and it is anticipated that demand will increase to 1,100MGD (5 million cubic metres per day) by 2030.

Current estimates indicate that UAE residents use about 550 litres of water and 20-30 kilowatt hours (kWh) of electricity a day, compared to the international average of 170 to 300 litres and 15kWh per day, respectively.

As the independent regulator of the water, wastewater and electricity sector in the emirate of Abu Dhabi, the Regulation and Supervision Bureau launched its Waterwise and Powerwise initiatives at the start of 2013, to promote the efficient use of water and electricity. Part of the Wise office's remit is to conduct studies and trials to gather data that ultimately helps establish better management of water and energy resources. Some of these exciting trials are described below.

Residential End Use of Water Project

The Residential End Use of Water Project aimed to investigate the complex drivers of residential water use, and collect reliable data about where, when and how households use water. The project involved the smart metering of 150 villas across nine gated communities in Abu Dhabi over three, two-week monitoring periods at different times in 2013. The data collected was broken down into actual end use using flow-trace analysis software.

Table 1: Average daily water use breakdown in litres on a per-household (lphd) and per-capita (lpcd) basis:

Total Use	Domestic Use	Leakage	Landscape Use
1679 (lphd)	882 (lphd)	124 (lphd)	643 (lphd)
% of total	53%	7%	40%
339 (lpcd)	168 (lpcd)	23 (lpcd)	149 (lpcd)
% of total	49%	7%	44%

Tap-use was the largest component of domestic water use, amounting to 34.3% of average daily household consumption. The other major categories were: shower use (21.1%), toilet use (19.4%) and clothes washing (11%). Homes that reported washing cars had a 13% higher tap use, while homes that used dishwashers reduced tap use by 2%.

The number of occupants in the home was the most important factor influencing water use, followed by the type of fixtures and appliances being used.

The results of this study provided real baseline data on water use within gated communities in Abu Dhabi. The next step is to examine water use within other property types to broaden the understanding of residential water use. This will support demand-forecasting models and future water-conservation programmes. Data can also be used in developing targeted communication campaigns addressing specific water-conservation areas.

Smart Metering Pilot – Energy Purchasing Trials

Peak demand has a significant impact on overall sector efficiency and power-generation capacity requirements. In 2013, Powerwise conducted a pilot project to assess whether consumer behaviour could be influenced, both to reduce electricity consumption and shift the demand pattern from peak to off-peak times.

The project involved 600 Abu Dhabi residential households, including a control group of 200 households who did not receive information about the trial. The trial group, comprising 400 volunteer participants, was given information on how to save electricity and provided with an electronic display unit that showed their consumption levels in real time. A virtual time-of-day pricing scheme was introduced, where peak rates (2pm to 8pm) were double the standard rate, and off-peak rates (8pm to 2pm the following day) were 40% cheaper than standard rates. At the end of the trial, volunteers received a personalised report showing how they performed during the trial, as well as a refund for any electricity they saved throughout the trial period.

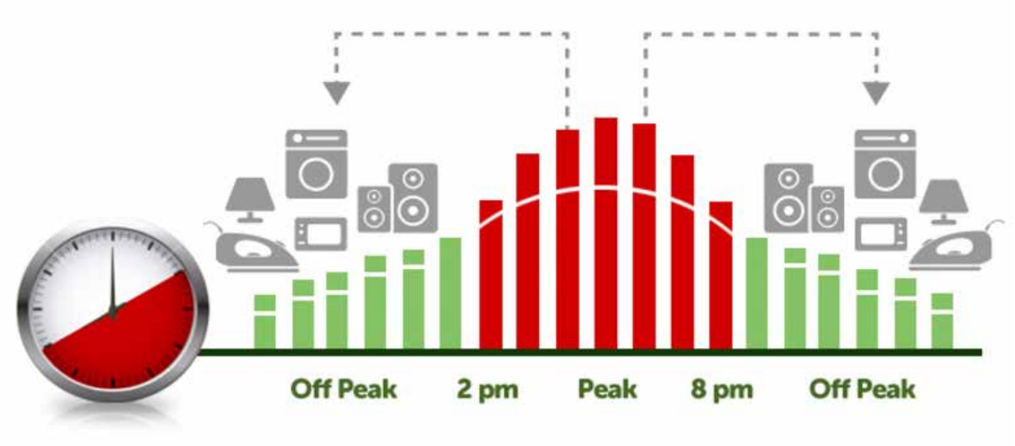


Figure 1: Peak electricity demand period in Abu Dhabi and peak shifting.

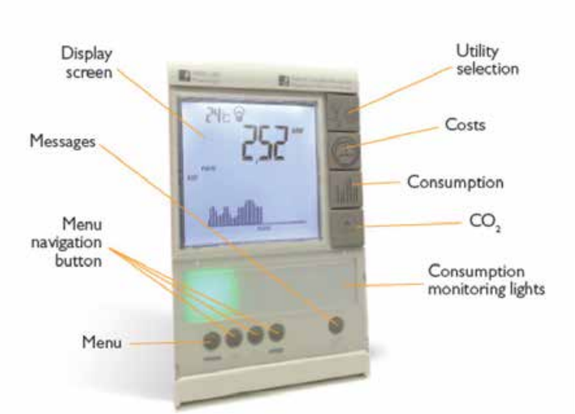


Figure 3: Time-of-Day Customer Display Unit (CDU)

FOOTNOTES

At the end of the study, the trial group had seen a 1725% reduction in peak demand, of which 16.49% was attributed to education and information. While no significant impact on load profile was observed, overall consumption was 16.8% lower than the control group. The impact of the time-of-day pricing was that 67% of the participants saved, on average, around 12% on their electricity bills under the trial.

This study demonstrates that educating and informing consumers is a powerful tool in driving behavioural change. This holds great potential for Abu Dhabi, where peak demand is expected to double by the end of the decade.

ABOUT RAMIZ ALAILEH



He is head of Powerwise. He was previously manager for Power Applications at DEWA, responsible for energy and distribution management systems.

ABOUT KHADIJA BIN BRAIK



She is head of Waterwise, which aims to promote water efficiency, particularly among residents, in Abu Dhabi. Khadija has over 10 years of experience working in the water and electricity sector.

FACT BOX

THE CONSERVATION AWARD FOCUSING ON GENERATIONS TO COME FOR A SUSTAINABLE FUTURE

The Conservation Award is an annual event held to encourage residents in Dubai to cut down on how much electricity and water they use, which is a key objective of the Dubai Integrated Energy Strategy 2030. Organised by DEWA, in cooperation with the Knowledge and Human Development Authority (KHDA), the Award focuses on the education sector, encouraging schools, students, teachers and parents to find better ways to reduce their energy and water use.

The theme, "For a better tomorrow", represents this forward-looking approach by recognising and rewarding conservation efforts by individuals and institutions across the educational sector, and offers special recognition to the personal accomplishments of students, teachers, faculty members, and administrators.

DEWA's partnership with KHDA has been successful in delivering results in the field of energy conservation. This is reflected in the impressive year on year achievements of those receiving the Conservation Award. The ninth award saw high rates of reduction in electricity and water use. Dubai's students, teaching staff, and educational institutions have reduced their electricity and water consumption by 10% and 21% respectively. Residents have reduced electricity consumption by 11% and water by 19%. Collectively, the award categories were able to save 23 million KWH of electricity and 128 million gallons of water, which has helped reduce CO2 emissions by 10,500 tonnes and save AED 16 million.

These results reflect the benefits of working jointly with a range of individuals and social institutions. They also underline the importance of encouraging Dubai's residents, educational institutions and students to help shape a sustainable future. ■

SMARTER THAN EVER

BRINGING THE VALUE OF THE SMART GRID TO CONSUMERS

COMMENTARY

By Dan Yates

> more than 85% of consumers in Dubai and Abu Dhabi (...) want to save energy

The vast majority of consumers want to save energy (more than 85% of consumers in Dubai and Abu Dhabi said so last year in a study commissioned by Opower), and the Dubai Integrated Energy Strategy includes aggressive energy-efficiency targets to hit by 2030.







So how can the UAE utilities help meet these targets? In the midst of the smart-grid revolution, they can employ big data and innovative technology.

To help customers save energy, utilities will leverage the three thousand-fold increase in electric usage data (via smart meters) to give them personalised insights and advice on how to trim energy bills, especially during peak seasons.

For innovative utilities, efforts like this are not self-defeating, but rather a compelling opportunity – to strengthen the relationship with their customers, to avoid the high costs of accommodating peak electricity demand, and to strengthen their bottom line by helping meet efficiency goals.

A smarter electric grid – and the unprecedented explosion in data that comes with it – sets the stage for utilities to offer many more products and services to help customers manage their energy demand: Wi-Fi thermostats that enable consumers to control the temperature of their homes remotely, effortlessly and energy-efficiently; diagnostic assessments of a building's energy-savings potential based on its time-of-use electric usage data; and easy-to-understand rewards programmes that give customers cash when they adjust their usage to take pressure off the grid.

As the customer's demand for self-generated clean energy grows, utilities need not sit on the sidelines. Around the world, creative utilities are running programmes that install and maintain smart-grid-ready solar-panel arrays on customers' roofs. The panels feed into the grid and the power company pays rental fees to those living or working under those roofs. The outcome is beneficial for all parties involved.

Embracing the energy priorities of tomorrow will enable power companies to move beyond delivering a simple commodity. Utilities will position themselves for success if they seek, as National Grid CEO Steve Holliday has suggested, opportunities to become "a total provider of energy services" and a "holistic manager of energy demand" for their customers.

If the first 100 years of the electricity industry have been about improving people's lives by delivering power, the next 100 years will be about giving them the power to use less. ■

ABOUT DAN YATES



As CEO, Dan Yates is responsible for the vision, strategy, and leadership of Opower. Under his leadership, Opower has become one of the fastest growing enterprise SaaS companies in the world. Dan co-founded Opower with Alex Laskey in 2007.

COOLER BY DESIGN

THE REGULATORY AND SUPERVISORY BUREAU ON ITS REGULATORY FRAMEWORK FOR DISTRICT COOLING IN DUBAI

COMMENTARY

By Graeme Sims



Seen from the viewing platform of Burj Khalifa, the world's tallest building, Downtown Dubai is a striking example of modern urban development. One notable feature is that none of the surrounding buildings, including Dubai Mall, has a roof cluttered with air-conditioning equipment. Instead, tucked away in a side street off Mohammed bin Rashid Boulevard and blending in with the surrounding sand-coloured buildings of the Old Town is a district cooling plant, meeting the air-conditioning needs of the surrounding area, Burj Khalifa included.

District cooling (or DC), the production and distribution of chilled water through a network of underground pipes, has been a distinctive feature of development in the UAE over the past 15 years, achieving the highest share of cooling demand of any GCC country. The Dubai Integrated Energy Strategy aims to build on this achievement and see DC take a still higher share of cooling, rising from its current circa 20%, to 40%, saving more than 3TWh by 2030. With plausible estimates of the overall growth in cooling demand, this could mean more than trebling the capacity of DC across Dubai.

Why has Dubai identified DC as a significant contributor to its energy-efficiency plans? And are those ambitions likely to be realised spontaneously or will they need a degree of policy making, planning and regulation to be achieved?

The economic and other benefits of DC are various. DC plants can employ large, water-cooled chillers capable of higher energy efficiency than small-scale building-level systems, whose chillers are typically air-cooled. These design advantages are compounded by the higher standards of operating and maintenance practices likely to be found in central plants that are permanently staffed. Serving larger loads across a district also reduces the cyclic operation of the cooling plant, which has a major impact on operating efficiency. The same effect allows capacity needs to be reduced, as diversity of peak demands can be captured in a way impossible when cooling is provided building by building. Added to these energy-cost impacts are the benefits that come from freeing up valuable roof space – who wouldn't prefer an infinity pool to a cooling tower or a battery of fans?

> "DC is different: its capital costs are recovered year by year through a capacity charge"

However, DC brings with it different challenges in implementing local cooling solutions. The greater the size of the cooling scheme, the more it begins to take on the characteristics of a classic utility, such as power or water. Schemes need to be carefully planned – not so early that plants lies idle whilst buildings go up, and not so late that occupancy is delayed or expensive temporary solutions have to be deployed.

Customers also have a different relationship to DC. In a conventional building air-conditioning system, the cost of the system is embedded in the overall cost of the property and the ongoing costs of the system are typically wrapped up in a service charge, recovered with no reference to consumption. DC is different. Its capital costs are recovered year by year through a capacity charge, and operating and maintenance costs, in particular electricity, are also separately identified. Even if those costs are then recovered in service charges, they are typically more visible. From the perspective of cost transparency and the economic incentive to conserve energy, this is positive. But this very transparency produces higher prices for DC than conventional cooling, even where its overall costs are lower.

The Regulatory and Supervisory Bureau (RSB) has been working on these issues for much of the past year, looking to develop a framework for DC in Dubai that will help deliver the energy strategy's ambitions and lead to outcomes that meet the needs of the DC firms themselves, as well as building developers and customers.

Dubai already has some forward-thinking policies in relation to DC. Thermal storage is required for all new, large DC plants, which reduces capacity requirements and levels demand on the power system. Alternatives to potable water for cooling are also encouraged, with treated sewage effluent used in several of the city's plants.

One new focus area is identifying cases where it makes sense to require buildings to connect to DC. This may not be necessary where new buildings are under the control of a master developer that has selected DC, but Dubai is keen to see existing buildings connect to DC and, here, a greater degree of control may be required.

Capacity planning is another essential element in a well-functioning DC industry. This issue is not unique to DC but there is an opportunity to improve the cooling-load estimates made for buildings, avoiding surplus capacity being installed, for which customers then have to pay.

Customers also need reassurance over the size of their bill. There are already examples of good practice in Dubai with clear billing where charges are properly explained and, where metering is installed, advice and encouragement to conserve energy. However, in other cases charges are not clear, leading to problems of revenue recovery and increasing the overall cost of the system. Increasing the penetration of sub-metering will also be instrumental in delivering savings – evidence from other countries points to savings of over 20% when customers go from paying a flat fee to paying on the basis of how much they use.

This is an ambitious programme of change and one requiring the engagement of all the industry's stakeholders to continue to make Dubai, and the UAE, a leading light in district energy. ■

ABOUT GRAEME SIMS



He is the Executive Director of Dubai's Regulatory and Supervisory Bureau. An Oxford-educated economist, he has over twenty years' experience of utility regulation in the UK and the UAE

FACT BOX

AJMAN GREEN BUILDING COMMITTEE

In January this year, high-ranking officials gathered in Ajman for the first meeting of the emirate's green building committee. The new body was formed following a decision by His Highness Sheikh Rashid Bin Humaid Al Nuaimi to modernise Ajman's building sector.

Members of the committee include senior officials from Ajman Municipality and Planning Department. The committee is chaired by Ali Bin Mohammed Khalifa Al Mowaji, the Executive Director of Support Services Sector in the municipality. Through this process, Ajman is working to produce a green building code for the first time, which will ensure new buildings in the emirate are energy and water efficient and have a reduced overall environmental footprint. ■



INTERVIEW

INTERVIEW: DAN YATES

CEO & Founder of Opower

OPOWER

Your company works with utilities in nine countries. Where do you see the potential in the UAE?

Dan Yates: First, there's a real need. Opower's technology platform helps utilities and their customers lower their energy use, and energy use in the UAE is relatively high. An average home in the UAE uses 7 times more electricity than the average home in the United Kingdom.

Second, we already have a strong partnership with Dubai Carbon. With their help, we can localise seamlessly and develop energy solutions that are ideal for the UAE.

And third, there's robust interest in the regulatory community. Dubai's energy plan is ambitious, and we're excited to play a role in it.

Since its launch in 2007, your software has delivered more than five terawatt-hours of cumulative electricity savings for clients around the world. What were some of the key factors in this success?

Dan Yates: For a hundred years, electric utilities in many parts of the world have operated as monopolies that provide a commodity reliably and without question. And in many parts of the world that commodity has been heavily subsidised.

Now that model is starting to shift. It's happening for a whole host of reasons — among them deregulation, competitive entrants that offer cleaner energy, or political bodies recognising that the old way of doing business no longer makes sense.

For most utilities, the end result will be greater competition in the marketplace. And an important area they'll need to focus on is upgrading the way they communicate with their customers.

It's instructive to look at what's happened in other regulated industries, like retail banking. Twenty years ago, we all had to do our banking at a branch; competition was pretty limited. But now that we can do everything online, there's more choice and more competition. Moreover, customers now expect their bank to offer financial advice on top of its traditional services. So in order to retain existing customers and win new ones, retail banks have become financial advisors.

As similar changes sweep across the energy landscape, utility companies have the opportunity to become energy advisors. And energy efficiency — helping customers use less power and save on their bills — is at the heart of that proposition. That's why we've dedicated our company to helping utilities better engage and advise their customers.

And we're in a pretty good position to do that. We've assembled a world-class team of data, behavioral and computer scientists and built a best-in-class customer engagement platform for the utility industry. By partnering with nearly 100 utilities around the world, we're analyzing more than 100 billion meter-reads a year and creating the biggest energy data warehouse on earth. And, like you mentioned, the end result is huge energy savings. The insights we've shared with utility customers have helped them save more than 5 terawatt-hours of energy — and that's not a guess. It's a direct measurement from statistically significant in-market studies, similar to clinical trials.

When it comes to targeting individual consumers, how is your energy efficiency approach different from more traditional approaches?

Dan Yates: The traditional approach to efficiency is to subsidise products and services, like energy-efficient light bulbs and refrigerators, and hope it accelerates widespread adoption. It typically doesn't.

To drive big results, you need to motivate people. This is where behavioral science comes into the picture. To get people invested in saving energy, Opower shows homes and businesses how their energy use compares to their peers' in a way that's clear and easy to understand. We do that because social norms are an extremely powerful motivator — far more than messages about saving money or the environment, it turns out.

That's the motivation piece. At the same time, we're also using our analytics engine to generate and deliver personalised energy insights, and show people opportunities to save energy at low or no cost. They take action because they care. And because the whole process runs on software, we can roll a programme out to millions of people at once, and reach them through whatever channels they prefer — web, mobile or paper.

The UAE has one of the highest rates of per capita electricity use in the world. Do you have any insights as to why this is the case, as well as ideas as to approaches that have not been tried before to encourage efficiency?

Dan Yates: There are a few factors at play, I think. Climate is obviously important — air conditioners and desalination plants are necessary in the UAE, and they use a lot of energy. Some of the industries the UAE specialises in are fairly energy-intensive. And because the economy is growing strongly, incomes are high and construction is thriving — both of which spur greater energy use.

The flipside of high per-capita energy use is that there are huge opportunities to reduce energy wastage. For example, McKinsey & Company found that 20 percent of residential energy use goes toward no purpose at all — cooling empty rooms or lighting empty buildings, for example. Solving problems like these is about changing behavior and educating people.

How important is price when it comes to its ability to motivate individuals to save power?

Dan Yates: I'll answer that by sharing a statistic. When Opower runs a program to help energy consumers change their behavior, we see energy savings rates that are equivalent to what you'd get by raising tariffs 25 to 30 percent. And it's a lot more painful to increase tariffs than it is to encourage a change in behavior.

Price and environmental impacts are rational ways to engage someone. But there are emotional tactics that are often much more effective.

To take one example, consider waste. We hate it. Wasting is something we're all hard-wired as human beings to not want to do. This is where behavioral methodologies come in, like showing people how much energy they're wasting compared to their peers who are more efficient. You can just key in to people's instincts to want to save.

To be clear, high prices do have an impact, but they're not a necessary 'ingredient' for successful demand-side management. We deliver very similar energy savings in regions where energy prices are relatively low.

Can you share your views on what to expect in the near future in the field of electricity generation and renewable energy, both globally and in the UAE?

Dan Yates: We're really excited about the increased penetration of renewables. At the end of the day, Opower's opportunities are linked to utilities evolving their business. Whether they're doing that on the supply side, with solar and wind, or the demand side, with efficiency and demand response, we're ready to help them make that next step.

We also feel confident that you need both. Renewables are still two to three times as expensive as conventional fuels, so in many cases, demand-side management is going to make the most sense for utilities — especially when consumers are pushing to keep energy prices low. The good news is that there are huge opportunities to buffer energy demand in real time — Wi-Fi connected thermostats, demand response programs, time-of-use pricing, and so on. It's a wild moment in the industry, but also a very exciting one. ■

Opower works with over 95 utility partners serving more than 50 million homes and businesses across 9 countries.

Combining data management, insightful analytics and behavioral science, Opower's customer engagement and energy efficiency platform positions utilities as trusted energy advisors to the customers they serve.



Get more kWh than alternatives

Deliver the most residential kWh possible across a territory, cost effectively.

Personalize the customer experience

Craft the best experience for each customer, with targeted messages that work.

Hit your efficiency goals with confidence

Unmatched quality, security, and data privacy from the most vetted, verified platform worldwide.

Visit www.opower.com for more on how utilities across the world are partnering with Opower to transform the way they relate to their customers.

OPOWER

MAINTAINING SMART CITIES

ARTICLE

By Simon Roopchand

> As at least 70% of a typical high rise building's utility bill in the UAE is associated with cooling



Demand Side Management (DSM) has recently gained momentum due to heightened sustainability awareness within Dubai's energy sector. The overall environmental impact per kilowatt hour of electricity consumed by the end user, in terms of primary fossil fuel consumption, relates to 2.63 kilowatt hours of gas, taking a gas fired power station as an example (Source: Carbon Trust UK).

The UAE's skyline is dominated by skyscrapers, with Dubai for example having over 3000 high-rise buildings in a 60 Km radius. There is a real potential to reduce energy through DSM in the UAE but optimising energy management in buildings requires a strategic approach.

To achieve significant improvements in the utilisation of energy, we need to consider the 'SMART Green Buildings' approach. This provides a holistic view of the building, allowing the identification of areas that can be upgraded, using new technology, throughout the building's life cycle.

Emrill Energy has a vision of supporting totally SMART Green buildings by 2019. This would include:

- The measurement and control of water
- Cooling
- The remote monitoring of significant energy consuming assets
- The introduction of waste segregation to increase recycling opportunities, hence reducing the carbon footprint
- Recycling water for desalination
- Using cooling system condensate to cool DEWA supply water in summer months

To implement ESGB there are four clear steps that need to be repeated over the building life cycle.





The ESGB model starts with an understanding of the architect's building design. It looks at the changes that have been made to the architectural intent and then the impact that it has on the building.

To keep a building optimised, it is essential to take the maintenance quality into consideration. A building starts degrading from the minute it is built. As a result, the systems and assets need to be understood not only based on the manufacturer's 'off the shelf' specifications, but also on the building's energy consumption and condition through its life cycle.

This can be done using Emrill Energy's Energy Centred Maintenance (ECM), which is a holistic methodology of reviewing asset life cycle alongside energy optimisation, in line with a building's design and operational requirements. ECM goes through a structured assessment process to create an individual management strategy for the building.

The financial model that supports the building is fundamental to its efficient operation. In the past, there has been a tendency to operate a 'run to fail' building service maintenance strategy, replacing assets only when necessary. However, the world of building maintenance is changing as the building stock ages within the region.

Following the analysis of the building owner/ client expectations in relation to forthcoming capital maintenance expenditure, financial options can be presented to the stakeholders that deliver different levels of maintenance and monitoring. These options predict the probability of system downtime within a building. They also provide a suite of Energy Conservation Measures (ECMs), each with a different Rates of Investment that can improve and upgrade the building as well as reduce energy consumption. Finally, the analysis would look at what Information and Communication Technology (ICT) could be applied within the given budget in order to optimise the building's performance as a SMART Green Building.

We are now in an era where ICT can help deliver a dynamically controlled building at a reasonable price with payback periods of less than 3 years. Historically, the majority of buildings in the region have been statically controlled. Parameters such as Relative Humidity (RH), external temperatures and occupancy have been controlled by either timed scheduling or manual adjustment. This is now changing: Emrill has devised a 4 level plan to introduce dynamic building control to the region.

Data from the 168 energy reviews completed by Emrill Energy show that typically 70% of a high rise utility bill is associated with cooling. These reviews indicate that an average of 24% savings can be achieved by the implementation of efficient control strategies.

In 2014, Emrill created the Energy Control, Operations and Maintenance (ECOM) Centre in its quest to measure and analyse Building Management System (BMS) performance alongside energy optimisation. The effects of monitoring buildings centrally requires a specialist engineer to overview system performance, alerting the sites to alarms and out of tolerance operations. This has assisted in reducing downtime associated with maintenance activities but has also kept the system controls running efficiently. A pilot study has been conducted on a number of buildings and the net result has been a reduction of 18% in energy consumption.

In mid-2015, Emrill will not only be measuring and monitoring building performance through their ECOM Centre, but will also have remote access to the BMS and Energy Management Systems so that its team of Control Specialists and Energy Engineers can remotely change operating parameters.

With the rapid deployment of ICT in the building services sector, it is predicted that by 2017 fully integrated information and control systems will be part of the Emrill portfolio, controlled centrally from the ECOM centre.

One challenge in delivering a truly SMART Green Building is that there may be a requirement for building system redesign. When introducing new alternative technologies, consideration must be given to existing regulatory requirements. In a region where energy and sustainability are key points of focus, it is envisaged that these regulations will become even more accepting of the new green technologies. ■

ABOUT SIMON ROOPCHAND



He is the General Manager of Emrill Energy Services, a division of Emrill Integrated Facilities Management Company that services corporations and communities across the UAE."



MOVING TOWARDS A CARBON-FREE ZONE

CASE STUDY UAE

By Eng. Muammar Al Katheeri

EXECUTIVE VICE PRESIDENT OF ENGINEERING MANAGEMENT DEPARTMENT AT DUBAI SILICON OASIS AUTHORITY ON THE MULTI-LAYERED CHALLENGE OF MANAGING THE RESOURCE DEMAND OF A DEVELOPING UAE

Overview

Environmental issues are being given priority more than ever today, especially with new developments taking place on the technology front. These developments include the rise of urban civilised cities and business parks, which are essentially classified according to their compliance with environmental standards. Increasingly, customers and residents are factoring in environmental considerations when planning investments.

Based on this, Dubai Silicon Oasis Authority (DSOA) considers the environment as a central issue that has been given core consideration in all its projects and initiatives. DSOA is also committed to implementing concepts that support its three waste management pillars of reducing, reusing and recycling.

DSOA focuses on creating a sustainable environment and increasing environmental awareness among the people living and working in DSO. For this purpose, we developed a framework that allows us to review our environmental objectives and targets. The strategy will contribute to maximising the use of all resources available to the DSO community, thus creating a healthier and safer environment in the long term.

Achievements

DSOA's notable environmental achievements include a saving of AED14.5 million since 2007 through water desalination and water irrigation initiatives that have generated around 11 million cubic metres of treated water. The sewage treatment plant at DSO is capable of treating more than 10,000 cubic metres of waste water per day, and we use the treated water to irrigate 7,000 square metres of landscaped areas in an eco-efficient manner.

We are also committed to providing an efficient and environmentally-responsible waste management facility. We recently distributed waste bins throughout the community with colour-coded containers for plastic, glass and paper for waste segregation. We are also encouraging other property developers at DSO to promote segregation in waste collection.

As for the equipment, the motors are carefully monitored by systems in order to control the speed of the engine and electric power frequency. All equipment, including pumps and water heaters follow a set operating schedule. For air conditioning systems, a building management system is in place to manage the schedule and control the temperature as needed.

DSO's Carbon Footprint

1. **Occupancy Power Sensors and Water Saving:**

   DSOA has introduced a series of initiatives to reduce the environmental impact at Dubai Silicon Oasis. For instance, the operation building is fitted with occupancy sensors that switch the power off automatically when a room is empty. To lower water usage, all taps in toilets and pantries come fitted with water-saving fixtures, while toilets and urinals have automatic flushing systems. As a result, we have successfully reduced water consumption by 40 per cent.

   Thanks to our building management systems, temperature and air circulation units are always optimised on the basis of need. These initiatives have resulted in a substantial reduction in DSO's water and electricity consumption.

2. **Compact Fluorescent Lamps**

   To drive our energy-saving target, we have replaced the external lights of our headquarters and are now looking at replacing 150 watts metal halide lamps with compact fluorescent lamps (CFL) in the DSO community.

   We have also equipped our headquarters with sensors that measure lighting levels and readjust lighting according to specific requirements. Lighting capacity especially in common areas, offices and corridors is monitored. Additionally, external lighting follows a set schedule.

3. Green Mat

DSO has a master plan for its landscaped area that covers roads, parks and other public facilities. After successfully covering the roof of our operation centre with Green Mat to save water, we are looking to replicate this concept across buildings in DSO. Made in part from date palm and coconut fibre, Green Mat can trap significant volumes of water in small amounts of soil and substantially reduce the need for frequent irrigation.

The integrated free zone technology park boasts a green area approximately equivalent to 382,000 square metres, in line with environmental requirements. The authority is also ensuring that water tanks and air conditioning pipes are cleaned on a regular basis.

4. Green Roofs

DSOA is continuing the sustainability concept in line with Dubai Municipality's green building regulations. DSO has a green roof area of 920 square metres that has successfully passed a pilot test for growing organic vegetables. An additional green roof area of 264 square metres will cover DSO headquarters by the end of Q3 2014.

Apart from protecting the building from extreme solar radiation, green roofs help in cooling the surrounding area as well as regulating the internal building temperature. Green roofs also lower the amount of energy required for cooling the building and eventually reduce net heat gain. This concept also limits the requirements for traditional insulation while providing sound insulation. The green roof acts as a membrane protection and offers a life extension for the building roof.

5. Enhancement of lighting system

DSO aims to install LED lighting across its headquarters. The project is already in progress with LED illumination implemented in various areas. Upon the completion of this process by end of 2014, a 10 per cent increase in energy saving is expected. With such efforts being made to enhance energy-efficient lighting, DSOA is scheduled to launch its first zero bulb building by the end of 2014. We are proud to announce that this metresbuilding, with 20,000 square metres of floor space, will be the first zero bulb building in the region that exclusively utilises LED lighting in all internal, as well as external, areas.

Additionally, DSO is set to launch new smart technologies to reduce energy consumed by the lighting system in the basement areas that include:

a. Sun Tunnel

In order to reduce the operational costs of electricity consumption by lighting systems, DSO is currently studying the possibility of redirecting sunlight to areas within the DSOA commercial towers and basements, with the first phase set to be implemented at the DSO headquarters.

b. Smart Power Metre

As a follow-up to the ISO certifications received, work on installing new smart power metres that can be used to effectively monitor and control power consumption in DSOA buildings has begun. Installation at the DSOA headquarters is expected to be completed by Q4 of 2014. Additionally, DSOA is studying the possibility of using the wireless network to connect all remote sites.

Certifications

.1 ISO Accreditation

Earlier this year, DSO received the ISO 50001:2011 certification for conforming to standards in establishing, implementing, maintaining and improving its energy management system and performance.

DSOA has also embarked on completing the LEED certification programme for its Techno Point building by early next year. The authority is currently in the process of planning and developing a strategy and reviewing feasibility studies to ensure that the majority of the buildings at DSO are LEED certified by 2018.

2. Emirates Energy Star Programme:

In two of its buildings, DSOA has implemented the Emirates Energy Star Programme, an energy saving initiative that is managed by M/s Etisalat and Pacific Controls. With the help of this programme that is using latest control technologies for energy optimisation, we have managed to reduce energy consumption in these buildings by 33 per cent in 2013.

	Implementation Date	Total Energy Saved	Total CO2 Saved	Equivalent to no. of trees Saved Yearly
Building 1	February 2013	395,964 KWH	234 Tons	50 Trees
Building 2	April 2014	159, 438 KWH	94 Tons	20 Trees

Following these encouraging results, DSOA is currently in the progress of implementing this programme at its headquarters.

Environmental CSR Initiatives

DSO's environmental CSR objectives are achievable only by continuously investing in energy solutions that align the DSO network with global standards. Such investments will ensure transparency in DSO's current energy usage, improve energy management, as well as translate into cost savings.

1. 'Keep DSO Clean'

In 2012, DSO launched its annual campaign 'Keep DSO Clean'. In its third edition, in Q1 2014, DSO collected 91 tonnes of garbage, a testimony to the urgent need for and effectiveness of the garbage disposal system that has been established.

In 2013, the DSO community along with Imdaad, its waste collection service provider, installed a garbage disposal system comprising several units including 1,607 recycle bins and 25 recycling centres. Nearly 365 tonnes of recycling material was collected from the recycling centres within DSO, saving an estimated landfill area of 871.5 cubic metres.

In 2012, the campaign focused on the issue of littering by motorists, and successfully collected 200 bags of refuse. In addition to distributing more than 1,000 specially designed car trash bags to drivers, the volunteers also urged residents, visitors and business executives of the DSO community to utilise the designated bins located within the tech park.

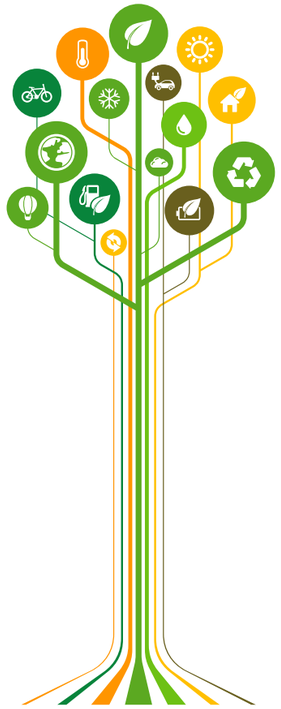
2. Energy Hour

Last but not least, DSO has been participating in the global Earth Hour initiative every year since 2008. Additionally, DSO is the only organisation that celebrates the 'Energy Hour' every month. On this day, Dubai Silicon Oasis encourages all people living or working in DSO to turn the lights off. This unique initiative, which was first introduced in Q1 2008, has allowed for the saving of 2,000 kilowatts of energy per month.

ABOUT ENG. MUAMMAR AL KATHEERI



He is the Executive Vice President of Engineering Management Department at Dubai Silicon Oasis Authority



Partnerships

Aiming to create a more harmonious society and to preserve the environment, DSOA has forged agreements with key partners such as the Dubai Carbon Centre of Excellence (DCCE) and Enviroserve.

As part of the agreement with DCCE, DSOA will play an active role in Dubai Carbon's Carbon Ambassador Programme, a national initiative from Dubai Carbon & Dubai Electricity and Water Authority (DEWA). The Carbon Ambassador Programme aims to bridge the distance between education and green industry through offering hands-on exposure, training, mentoring and project delivery, in association with the United Nations and key industry players.

The MoU with DCCE will also allow DSO to become a partner in the green jobs programme. Through this programme, DSOA will aim to shed light on career opportunities in the environment sector, and focus on the skills needed by today's youth to help the UAE transition into a low carbon economy.

We have also signed a MoU in 2010 with Enviroserve, a public-private partnership with the UAE Ministry of Environment and Water, for the effective disposal and recycling of electronic scrap collected from DSO premises.

The agreement brings DSO in line with the International Environmental Standards in electronic waste/scrap management, and ensures that mobile phones and other obsolete electronic items are disposed of in an environmentally-responsible manner.

This MoU articulates our efforts to fulfil our corporate environmental responsibility, on which we place significant importance. It also complements the UAE Government's drive to introduce, monitor and develop green initiatives and environmental issues of relevance to the country. While the advanced technological environment we offer is unique, it is equally important that we are proactive about green initiatives to ensure future generations can enjoy tech-innovations in a clean and healthy environment. ■

THE JOURNEY TO SUSTAINABILITY: NO TIME TO WASTE



We live in a throwaway society, where the items we purchase come wrapped in layers of non-biodegradable plastic that ultimately ends up in landfill. The level of solid-waste generation is a striking by-product of civilisation, with the biggest waste-producers being the economically stable nations of the world. This year, the world will generate more than 1.1 trillion kilogrammes of waste, and every year this volume increases by around 3%. Without action, population growth and urbanisation will accelerate solid-waste generation, making waste reduction a vital issue in ensuring the future health of the planet.

In the UAE, studies by the Centre of Waste Management Abu Dhabi in 2010 estimated that between 1.8kgs and 2.4kgs of rubbish is produced per person per day, making waste management an important concern. Dubai Municipality has been tackling this issue in a number of ways, from developing legislation around waste management to instituting recycling schemes across the Emirate. In recognition that education and awareness are essential elements in addressing waste, the waste-management department of Dubai Municipality also launched the innovative Ambassadors of Sustainability programme in 2013.

The Ambassadors of Sustainability programme is now entering its second phase, following on from the highly successful launch year. The initiative aims to train students in practical approaches to sustainable environment and waste-management issues in Dubai. Dubai Municipality is collaborating with a range of educational institutions, providing separate training packages for secondary and higher secondary school students, as well as for college students.

Through the Ambassadors of Sustainability programme, Dubai Municipality trains students on how to carry out lectures and workshops on various environmental topics. The civic body also hosts workshops on how to practice sustainable waste management through reuse and recycling methods. Students who complete the training are certified as Ambassadors of Sustainability and qualified to conduct awareness activities on sustainable waste management, including giving lectures and workshops and participating in field visits to targeted institutions. Students with artistic flair are also trained on how waste items can be converted to useful objects or art projects.

Dubai Municipality has trained hundreds of students to date and the Ambassador of Sustainability pool already has 120 qualified students as a result of the 2013 programme. More than 50 government and 25 private schools joined the initiative. In addition to the certified Ambassadors of Sustainability, approximately 3,000 students benefited from the workshops. The programme is now building momentum, attracting a high number of students who are committed to spreading the culture of sustainability in matters related to environment.

A number of new projects in sustainable waste management in the Emirate have come about due to the programme, including tyre parks and organic compost generation. Last year, two students were honoured for their outstanding projects and suggestions. Maryam Khalid, from Dubai National School, presented a sustainable project on promoting the role of families in residential areas in eco-friendly waste management and Fatima Al Marzooqi, from Zayed University, forwarded an idea about the effective collection of waste from vehicles.





In 2014, the first Ambassador of Sustainability to be honoured was Kehkashan Basu, who presented her "Green Hope" team's sustainable project on promoting the role of students in eco-friendly waste management. It is this kind of thought leadership that Dubai Municipality aims to nurture through the Ambassadors of Sustainability programme.

The 2014 programme includes activities under the heading "My School, My Environment" where students are encouraged to present or initiate creative ideas in separating and sorting waste and reducing waste in schools. The "My School Green" project asks students to develop innovative ideas in regards to rationalising water and electricity consumption in schools, and increasing the allocated green areas in educational institutions, and planting these zones in a sustainable way to increase the environmental appeal.

Initiatives such as Dubai Municipality's Ambassador of Sustainability programme play an important role in driving awareness, in line with the directives of the leadership of Dubai on the adoption of environmentally friendly policies and strategies. Dubai Municipality aims to foster positive change in public attitudes towards environmental issues, and the youth are the most capable people to carry this mission to wider sections of society, ensuring a sustainable future. ■

OUR CORPORATE HEROES

EFFECTIVELY MANAGING YOUR BUSINESS INCLUDES MANAGING YOUR ENERGY RESOURCES

> if the corporate sector [in the U.S.] increases efficiency by 3% per annum it could unlock $190 billion in savings by 2020

COMMENTARY

By Tamara L. Withers



The private sector plays a unique role in improving energy efficiency in buildings: sector leaders have direct influence on how energy is consumed within a building; they can persuade employees to change behaviour not just at work, but also at home; and they can influence how suppliers and business partners manage their energy. Some businesses are also central in bringing energy-efficient technologies to the market and can play a role in financing energy-efficiency initiatives. Saving energy is about reducing wasteful consumption and becoming more efficient, which in turn will reduce operating costs that can be redirected into growing the business. These savings can be realised with improved energy efficiency, through behavioural or management changes and technology improvements. However, in the UAE, businesses also face many barriers that prevent them from being able to use energy more efficiently.

Companies that successfully manage energy consumption can reduce costs, support innovation, and increase their profile as responsible corporate citizens. Sustainability policies can also increase employee loyalty and help secure customers and financing from a market that is increasingly expecting companies to adopt leadership on climate change.

For example, it has been calculated that in the United States, an energy-efficiency improvement from the corporate sector of 3% per annum could unlock $190 billion in savings by 2020. Although on a larger scale, this demonstrates that investing in energy efficiency makes business sense. Taking such action in the UAE would mean that businesses could support national and local policies and prepare themselves for potential future regulation.

There is significant potential for the UAE to reduce its carbon emissions and capitalise on the benefits of doing so. Carbon dioxide (CO_2) emissions contribute 87% of all greenhouse gases emitted in the UAE. The majority of these emissions originate from energy generation and water desalination. The World Bank places the UAE as the 14th highest global consumer of electricity per capita, as per 2011 data. In Abu Dhabi, the commercial sector accounts for 25% of electricity consumption.

As much as one third of total global greenhouse gas emissions can be attributed to the operation of buildings and they offer amongst the largest share of cost-effective opportunities for GHG mitigation. According to the International Energy Agency (IEA) it is possible to achieve cost savings of up to 28% with energy-efficient retrofitting.

Achievements

Through our Corporate Heroes Network, EWS-WWF has worked with committed UAE organisations to reduce energy and water consumption and their carbon footprints. Organisations submitted case studies to illustrate their energy savings, describe retrofits, and highlight lessons learned. What these organisations achieved proves that simple, cost-effective changes can reduce energy consumption and provide financial benefits to the organisation. These case studies demonstrated that on average, it was possible for a company to achieve a 12% reduction in energy consumption (equivalent to saving 19,460 barrels of oil) with a payback time of less than 16 months. The range of energy saved was 11-55%.

How They Did It

Participants achieved these savings by implementing a mix of behavioural and technical retrofits, some of which include:

- performing regular A/C and office equipment maintenance
- setting the thermostat between 23-25C
- de-lamping
- switching to energy-efficient lighting and office equipment
- installing light sensors
- engaging staff: forming green teams, staff training, communications

Lessons Learned

Other organisations in the UAE seeking to reduce energy consumption should take note of several lessons learned from the case studies. First, data collection is often challenging due to lack of access to meters or utility bills and inaccurate data. Having access to data is key in order to identify high-consuming areas and track savings. Effective staff engagement is also instrumental for achieving savings, where for example, staff support will augment savings through behavioural change and the contribution of energy-saving ideas. It is also better to initially focus on implementing simple, low-cost measures, as these can be more easily incorporated into existing budgets, while helping to demonstrate success and gain senior management support for larger projects. This also highlights the importance of sharing success – managing data in terms of kwh and dirhams-saved helps illustrate the financial case to senior management and gain support. Selecting the best measures to improve energy efficiency will also require a well-trained and capable energy manager to conduct due diligence and evaluate the growing number of products and services now available in the UAE market. Finally, as a Verified Corporate Hero noted: "Having highly efficient systems does not automatically guarantee reducing consumption. It is key that systems are understood, integrated, and optimised for savings."

In conclusion, achieving large-scale reduction in energy consumption across the private sector will require a combination of development and enforcement of government regulations and policies, as well as action from the private sector.

From a regulatory perspective, having systematic programmes to improve metering and billing would help organisations access more accurate energy data for their premises. Availability of accurate data would also allow buildings and companies to benchmark energy-use performance. While it is important for individual businesses to manage their own energy, it is also necessary for energy to be managed at the building level – and not just at occupant level. Businesses, building owners, and property managers require financial incentives to implement energy efficiency to lower upfront costs and improve rates of return. Financial incentives such as more cost-reflective energy tariffs, rebates, duty exemptions, grants, and green loans all have an important role to play. In addition, the UAE needs access to a marketplace with high-quality, cost-competitive products and services. This can be facilitated by ensuring that existing UAE energy performance standards for energy-consuming devices are improved over time, that new appliances are also regulated and that labelling schemes provide appropriate information to enable consumers to make informed decisions (e.g. payback periods, CO_2 savings).

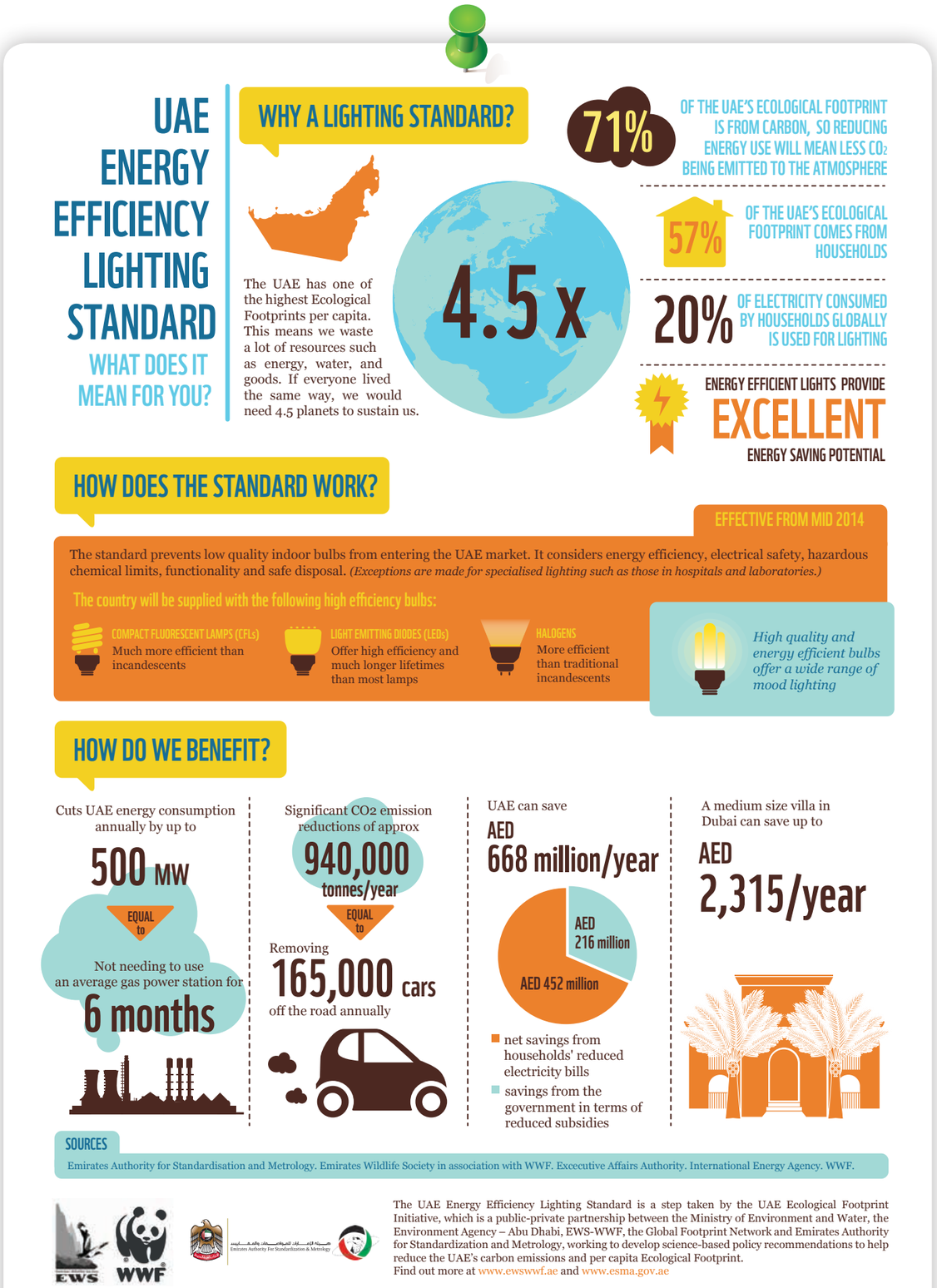
We also recommend that businesses should not just wait for government policies to take action. The organisations that we have worked with over the years under the Corporate Heroes Networks have clearly demonstrated that it is feasible and it makes business sense to manage energy efficiency now. For those ready to manage their business more effectively, the first step is developing an energy consumption baseline. With that, organisations should evaluate and select energy-efficient measures to implement. It is then important to track energy consumption, document results, and develop a long-term strategy for continued savings.

> These case studies demonstrate that (...) it was possible to achieve a 12% reduction in energy consumption (...) with a payback time less than 16 months

ABOUT TAMARA L. WITHERS

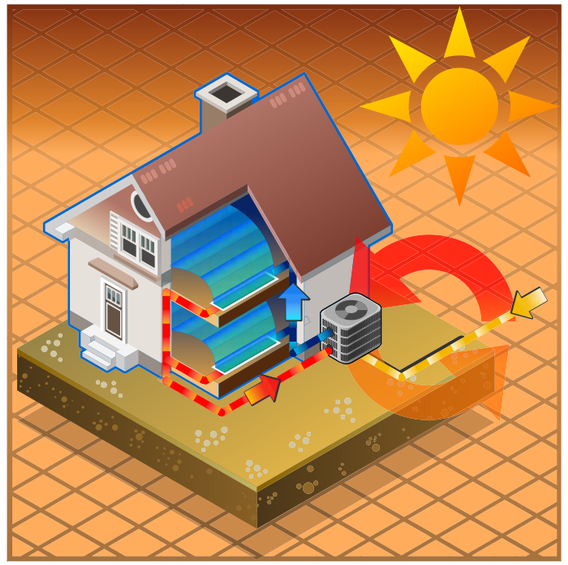


She joined EWS-WWF in November 2009 and is currently leading EWS-WWF corporate sustainability work focused on climate change under the Heroes of the UAE programme.



LABELLING SUCCESS

ENERGY EFFICIENCY STANDARDS AND LABELLING FOR AIR CONDITIONING SYSTEMS IN THE UAE ARE CURTAILING COSTS AND ENERGY CONSUMPTION



ARTICLE

By Abdullah Al Maeeni

In the UAE, the Emirates of Abu Dhabi and Dubai have initiated Demand Side Management (DSM) and energy-efficiency campaigns to curtail an increase in demand triggered by high levels of projected economic and population growth.

As part of DSM, measures can be implemented under which different consumer classes reduce their demand at particular times when given a signal to do so. These are called Demand Side Response (DSR) measures. DSR can play a key role in reducing the generation infrastructure investments required to meet peak demand as well as in optimising how the UAE power systems operate. For UAE consumers, the key benefits of DSR are reduced energy costs (or sustainability of low prices) as well as secure system operations, i.e. reduction of outage risks.

In the development of DSR strategies, two areas need to be addressed:

- How is the DSR ecosystem created; and
- How can comprehensive participation by all relevant stakeholders be established?

Both aspects are interlinked – the first seeks to develop the most efficient structure, with the second ensuring the right group of participants in the DSR eco-system.

Star Rating for Room Air Conditioners

STAR RATING	*EER LIMITS (Btu-h) / W at 46°C
5	EER ≥ 7.11
4	7.10 ≥ 6.81
3	6.80 ≥ 6.51
2	6.50 ≥ 6.31
1	≥ 5.90

*EER – Energy Efficiency Ratio
EER (Btu-h) / W = Total Cooling Capacity (Btu – h) / Effective Power Input (Watts)

Energy Efficiency Label

The Energy Efficiency Label (EEL) is granted to a product that complies with the Energy Efficiency Requirements. As mandated by law, manufacturers should attach the EEL to the product to guide and educate consumers when they make their purchase decisions. The EEL tells the consumer the star rating of the products they are buying together with the expected annual consumption. The higher the star rating, the more efficient the product is. To further strengthen this process, local government authorities monitor the market to ensure that manufacturers and retailers comply.



The Energy Label for Room Air Conditioners

Incentives for Energy Efficient Air Conditioners

In addition to the campaign to educate consumers and end-users about the importance of buying energy efficient products, ESMA has also designed an incentive program to encourage manufacturers to import more energy efficient products in to the UAE. The incentive structure is as follows:

INCENTIVE FOR IMPORT OF EFFICIENT ROOM AC

STAR RATING	PRICE OF ENERGY LABEL (AED)
5 Star	Free
4 Star	1
3 Star	3
2 Star	5
1 Star	7

Based on the above, the Energy Label issued by ESMA for the most efficient, 5 star rated products is free. Gradually, payment for the energy label increases as the number of stars decreases. For every 1 star rated AC product that is imported, the manufacturer has to pay AED 7 for the energy label.

Results of implementation of Energy Efficiency Standards and Labelling Programme

Quantity of Room Air Conditioners entering the UAE Market

	2012	2013
Star Rating	Quantity	Quantity
1	215,854	161,259
2	234,330	154,266
3	114,763	197,547
4	92,213	60,225
5	97,518	60,703
Grand Total	754,678	634,000

Savings from the implementation of Energy Efficiency Programmes against what would have been available in the market if the program does not exist

SAVINGS	YEAR 2012	YEAR 2013
AED	10,636, 596	77,309,909

Savings from the implementation of Energy Efficiency Program

SAVINGS	YEAR 2012	YEAR 2013
KW-H	212,731,920	1,546,198,199

Proposed New Requirements for Room Air Conditioners

To further improve the energy efficiency performance of room air conditioners, ESMA has developed a set of new Energy Efficiency Requirements that are expected to be implemented by Q4 of 2015.

The new requirements cover the following:

- Improvement of the existing technical requirements for Room Air Conditioners (mainly window- and the split non-ducted room type air conditioners.
- New requirements for the minimum energy performance standards for residential, commercial and industrial air conditioning systems, including ducted air conditioners using air and water-cooled condensers and ducted air-to-air heat pumps, water-sourced heat pumps, water-chilled packages, and multiple split system air conditioners and air-to-air heat pumps.

Proposed Energy Efficiency Requirements for Room Air Conditioners

Star Rating	EER (Btu-h) / W at 46°C Window Type AC	EER (Btu – h) / W at 46°C Non-Ducted Split Type AC
5	EER ≥ 8.51	EER ≥ 9.01
4	8.50 ≥ 8.01	9.00 ≥ 8.31
3	8.00 ≥ 7.51	8.30 ≥ 7.71
2	7.50 ≥ 6.81	7.70 ≥ 7.11
1	6.80 ≥ 6.30	7.10 ≥ 6.80

The proposed requirement once approved will have two criteria for different types of room air conditioners. Window type AC will have a minimum efficiency requirement of 6.30 Energy Efficiency Ratio (EER) while the non-ducted split type AC will have a minimum energy efficiency ratio of 6.80.

Once the new requirements are introduced, window type air conditioners that fall under the current 1 star category will no longer be accepted. Non-ducted split type air conditioners will have stricter requirements, with equipment meeting the current 3 star category or below no longer accepted on the market. The previous 4 star energy efficiency rating will be downgraded to 1 Star.

Requirements for Commercial and Central Air Conditioners

Commercial and central air conditioning systems also represent a significant volume of energy consumption, and ESMA has also developed appropriate Energy Efficiency Requirements. These are set out below:

Minimum Performance Standards for Split and Packaged Units

Rated Cooling Capacity (CC)	Minimum Energy Efficiency (EER) (Btu.h / watt) at 46°C
CC < 135000	8.10
135000 ≤ 240000	7.90
240000 ≤ 760000	7.50
760000 ≤ CC	7.20

Minimum Performance Standards for Water Sourced Heat Pumps

Type	Water or Fluid Temperature (°C)	Rated Capacity	Minimum Energy Efficiency (EER) (Btu.h / watt) at 46°C
Water Source	30	All	7.90
Ground Water Source	25	All	8.70

Water Chiller

Cooling Type	Rated Capacity (KW)	Coefficient of Performance (COP) Full Load at 35°C (Btu/h/watt)
Air Cooled Packaged Units	CC < 630	8.50
	630 ≤ CC	9.50
Water Cooled Chillers	CC < 528	13.50
	528 ≤ CC < 1055	15.00
	1055 ≤ CC	17.00

Multiple Split System

Rated Capacity (Btu / H)	Minimum Energy Efficiency (EER) (Btu / h / watt) at 46°C
CC < 90000	8.30
90000 < CC ≤ 135000	7.80
135000 < CC	7.50

ABOUT ABDULLAH AL MAEENI



He is the Director General of the Emirates Authority for Standards and Metrology – the National Standards Body of the UAE.

ECO-CITY WORLD SUMMIT 2015, ABU DHABI, UAE

FACT BOX

By Ahmed Bahroon

The Ecocity World Summit (ECWS) is a forum held every two years for the international community to discuss ecological city design, development and functioning, whilst promoting healthy cities in all their aspects for the long-term vitality of living systems. A key objective of this summit is to push the boundaries forward in bringing people together for promoting and building ecologically healthy cities, towns and villages.

Every second year Ecocity Builders selects a city to host the next edition, from a number of bidding cities. In 2011 it was the Montreal Summit, in 2013 the city of Nantes, France hosted the event and in 2015, Abu Dhabi has won the bid to host.

Hosted by the Environment Agency - Abu Dhabi (EAD) facilitated by Abu Dhabi Global Environmental Data Initiative (AGEDI), in partnership with Abu Dhabi Tourism & Cultural Authority (ADTCA) and with the support of the Abu Dhabi National Exhibition Centre (ADNEC) and Etihad Airways, the event will take place in October 2015 at ADNEC. The overarching theme of this event will focus on Ecocities in a challenged environment. It will address issues relating to leadership in an environment of rapid growth, sustainable urbanism, knowledge-building and action for an ecological society, and respect for nature as foundation for local culture. In addition, the event will have a policy component, concentrating on strategies from policy to implementation and cities and climate change. The event will cater for over 2,000 delegates over three days. It will also offer a social programme including kayaking in the mangroves and bird watching at Al Wathba wetland reserve. For more information on the event, visit the website www.ecocityworldsummit.org

05

ENERGY DIVERSIFICATION & INNOVATIVE TECHNOLOGIES

HIS EXCELLENCY
DR. MATAR HAMED AL NEYADI

UNDERSECRETARY OF THE MINISTRY OF ENERGY



Rising populations, increased wealth in more countries, global economic competition, growing global demand for energy resources, security of supply and stronger awareness of environmental issues – these are the unique challenges facing the energy sector today.

The UAE, too, has been facing some of these issues, even though it is endowed with plentiful hydrocarbon resources. Today, our leadership is well aware of the need to produce energy as efficiently as possible, at affordable costs and significantly lower pollution levels. Technology will play a significant role in balancing our need for continued prosperity with the duty to preserve a clean environment for future generations.

Our decision-makers have taken bold steps and the country has invested in new ways of producing power. This has established the UAE as a leader, not only in the Gulf and the Middle East, but also in world terms.

Solar technologies now provide a small but growing portion of our energy-generation capacity. While cost remains an issue in determining how widely solar is used in our country, prices are continuing to fall for some technologies. The UAE's harsh climate presents several challenges in the efficiency of solar generation, but this is also an opportunity to innovate.

The UAE is also investing significant amounts in nuclear power, and is the first GCC country to gain access to peaceful nuclear technology. Additionally, we are pioneering carbon capture and storage – a technique which aims to reduce emissions from traditional power generation. This trial means we are joining global technology leaders at an early stage, and this has great potential to reduce the impacts of fossil-burning plants, which will continue to dominate the way energy is produced globally.

Our significant investments in new energy technologies will ensure greater diversification of sources and a lowering of our carbon footprint. This also offers excellent opportunities for young, educated UAE nationals to embark on exciting careers. They are an intrinsic part of our Government's overall strategy in creating a diversified, knowledge-based economy that allows for the continued prosperity of our nation.



EMPOWERING THE UAE THROUGH ENERGY DIVERSIFICATION

MAIN REPORT

By HE Eng. Mohamed Al Hammadi

The UAE is pioneering responsible energy policymaking in the region by leading one of the most decisive energy diversification processes in the world. The nation is transforming its energy infrastructure through a carefully planned and sustainable diversification strategy that will power the nation's economic, industrial, and social growth, as well as bring new career opportunities for Emiratis and local companies.

> The nation is delivering an ambitious and strategic process to diversify its energy portfolio with less reliance on fossil fuel-based technologies

This forward-thinking energy strategy is inspiring other nations both in the Arab world and across the globe to engage in a diversification of their energy portfolios to increase the reliability and sustainability of their energy sectors.

In order to ensure the steady provision of energy in all its different forms, energy policy makers need to make strategic decisions and prioritise inputs into its decision process. This will achieve a balanced energy solution that suits the interests of the nation. In its ideal state, a robust and diversified energy policy delivers a reliable, stable and sustainable supply of energy at affordable prices, and ensures that security of supply is constant and resilient.

This is certainly the case in the UAE: the nation is delivering an ambitious and strategic process to diversify its energy portfolio with less reliance on fossil fuel-based technologies. However, this drive to diversify is the result of a sophisticated and long-term focused energy planning exercise.

Years ago, energy policy makers in the UAE made the strategic decision to produce a long-term, focused strategy, for energy diversification. In order to do this, they engaged with a range of national energy entities, and drew upon data forecasting, scenario planning and international best practices.

The results showed that continuing to invest in fossil fuel plants, such as natural gas, and, in particular, the cogeneration of water and electricity, could potentially decrease the level of energy independence. This is because the UAE would be dependent on foreign nations to secure these resources.

Therefore, energy diversification became a matter of strategic importance for the nation and the decision was made to construct new power plants that utilised alternative sources of energy, rather than adding to the 30-plus fossil fuel based plants that generated electricity and water at that time.

> The approach the UAE has taken in venturing into these new energy sectors is more than just a mere financial investment

The outcomes of this study became a series of strategic investments in commercially viable forms of electricity generation such as renewables and peaceful nuclear energy. Today, we are witnessing the biggest push for energy diversification in the history of the UAE - we are already receiving the first kilowatts of renewable energy from Shams 1, the world's largest solar concentrated plant. And two peaceful nuclear energy plants are on track to start supplying safe, clean, reliable, and efficient electricity from 2017.

The impact is that in less than a decade, nearly 30 per cent of all electricity will be provided by clean energy. This is a remarkable achievement for a country that, a little more than a year ago was generating all of its energy through fossil fuels.

However, the approach the UAE has taken in venturing into these new energy sectors is more than just a mere financial investment. Energy diversification is far greater than just importing the technology and expertise to build new power plants, it is a powerful engine of growth.

Instead of relying solely on foreign resources to build and operate the country's new power plants, the UAE has taken a sustainable approach that will rely on Emirati capacity in these fields. The country will also develop renewable and nuclear engineers required to lead this new wave of Emirati energy companies responsible for pioneering these new industries.

If the oil and gas sector offered high-value and rewarding career opportunities for young Emiratis in the 60s and 70s, then why can't these new energy sectors do the same? And if the oil and gas sector was the precursor to the creation of Emirati companies that drove this multibillion industry, why shouldn't it be possible to replicate this success story in the field of renewables or nuclear energy?

> Through energy diversification, the UAE is not only securing power for the future, it is empowering its people to lead the energy market of the future

The result is a sophisticated approach to energy diversification: one that involves the creation of a new infrastructure that generates research and education facilities specialised in these emerging forms of energy. It also involves working with local companies to improve their expertise and prepare them to service a new multibillion energy industry. The drive to diversify the energy infrastructure through the creation of engines of growth that transcend the mere generation of power and involve new academic curricula and industrial sectors is an ambitious approach, but it is one that will re-shape the UAE's economy and contribute to the sophistication of its resources. The UAE's vision additionally includes competing with other nations across the world on the development of new projects in foreign nations. We are already witnessing the first set of international energy projects awarded to Emirati companies, and their success is an inspiration to all of us working in the energy sector.

The UAE is an example of responsible energy diversification. Today, any nation seeking to secure sustainable growth can look to the UAE as a powerful case study, and the country has quickly become a reference for other nations seeking to diversify from fossil fuel-based energy infrastructures, into a broader, more sustainable energy policy.

Through energy diversification, the UAE is not only securing power for the future, it is empowering its people to lead the energy market of the future. ■

"The UAE's vision additionally includes competing with other nations across the world on the development of new projects in foreign nations"

ABOUT HE ENG. MOHAMED AL HAMMADI



He is the Chief Executive Officer of the Emirates Nuclear Energy Corporation (ENEC) and the Chairman of the Emirates Project Management Academy (EPMA).



NATURAL GAS - THE FOUNDATION

ARTICLE

By Ibrahim Ahmed Al Ansaari



THE CHIEF EXECUTIVE OFFICER OF DOLPHIN ENERGY ON THE ROLE OF NATURAL GAS IN THE UAE ENERGY SECTOR

In recent years, conversations about the development of the UAE energy mix have tended to focus on the push for renewable energy and the pursuit of a civil nuclear programme.

Little was made of the role of natural gas, perhaps because it was a given within the energy mix or perhaps because those projects overseen by Masdar and the Emirates Nuclear Energy Company were ambitious in their vision to meet the growing demand for energy. Both present compelling solutions that help meet the demands for power as industrial development grows and the country's population increases.

Natural Gas Lies at the Heart of the UAE Energy Mix and Will Continue to do so for the Foreseeable Future

Yet it is important to appreciate the role natural gas plays in meeting domestic demand and ensuring hydrocarbon exports are maintained to fulfil existing contracts. Estimates by Wood Mackenzie suggest that two thirds of the gas consumed in Abu Dhabi is currently used to maintain and enhance oil production. With plans underway to increase oil production, demand for more gas will also increase in the short term.



Indeed figures from the US Energy Information Administration (EIA) reveal that between 2003 and 2012, the UAE's demand for natural gas increased at a rate of 5.3 per cent. The last decade has witnessed strong economic growth, backed by rising crude oil prices. The challenge has been meeting domestic demand without affecting the ability to export. The response has been the diversification of the energy mix – a blend of conventional and unconventional sources, renewable and nuclear.

At the heart of energy security in this country is the role played by natural gas. It could be argued that the UAE, where gas volumes supplied either by ship or pipeline are critical to energy security, is a microcosm for the rest of the world. One only has to look at the efforts undertaken to secure additional volumes of natural gas to appreciate the role of this resource is front and center of any existing and future energy mix.

And we are contributing to that energy mix. By providing 30 per cent of the UAE's energy requirements, Dolphin Energy plays an important role in maintaining energy security for the country. In 2013, we achieved 100 per cent plant availability – the fifth year in a row we have done so. We are integral to the UAE's energy security, and because supply is reliable, it has allowed focus to be fixed firmly on the development of other forms of energy.

The value of natural gas can be illustrated by the recent launch of several projects that will support the UAE's transition to a low carbon economy. These projects respond to increasing domestic demand and will help address the gas shortage whilst a decision is made by Qatar on the supply of additional volumes.

The US$10 billion Integrated Gas Development Project (IGD), which is being developed by GASCO, ADGAS and ADNOC in partnership with IOCs Shell, Total and Partex, could, according to the Energy Information Administration (EIA), produce 2 billion standard cubic feet of natural gas per day (scf/day). In addition, the Offshore Associated Gas (OAG) project which began in 2010 has a capacity of 200 million scf/day, providing increased volumes for domestic consumption.

The development of the Shah and Bab gas fields indicate the size of the demand – both are known to have a relatively high sulfur content making them highly corrosive and difficult to process. Yet technological advances are such that, despite the challenges associated with sour gas, both projects can be successfully developed to meet growing domestic demand. Al Hosn is well into project phase and when commissioning starts, 1 billion scf/day will be produced. Volumes of unconventional gas produced in the Bab field will contribute 500 million scf/day from 2020, according to ADNOC.

> (...) between 2003 and 2012, the UAE's demand for natural gas increased at a rate of 5.3 per cent

And then there's Emirates LNG, the new Mubadala Petroleum-IPIC venture that will receive shipments of LNG at Fujairah for the UAE. Estimates suggest that up to 43 bcf per year – 600 million scf/day – could be provided for domestic use.

In addition, ADNOC's Gas Directorate is addressing gas sector challenges with support from Mubadala, Emirates LNG and Dolphin Energy and in June of this year, ADGAS announced it planned to increase production to as much as 2.4 billion scf/day by 2017 by expanding its current facilities.

The Challenge is in Meeting the Need for Gas

Aside from developing new sources of gas, another way to ensure demand is met is in the development of new technologies and entirely new sources of energy. Therefore, other ways to meet demand have started to be developed. Carbon capture, usage and storage techniques that would free up gas, currently used for enhanced oil production, are being developed under a joint venture between ADNOC and Masdar. It is hoped that the project will sequester up to 800,000 tonnes of CO2 annually.

In addition, the ongoing commitment to increase the share of renewable energy will help free up volumes required to meet the increase in anticipated demand and support Abu Dhabi and Dubai in meeting their renewable energy targets. Renewable energy will help complement the UAE energy mix, free up the use of natural gas and support the government in its quest to transition to a low carbon economy.

Nuclear power will do the same. In his address to the New Nuclear International Conference in Abu Dhabi at the end of last year, the UAE Minister for Energy, His Excellency Suhail Mohammad Al Mazroui, highlighted the challenge to increase energy generation to meet demand, while ensuring the impact it has on global warming and climate change is minimised. The Minister outlined the case for nuclear energy and its ability to help meet this particular challenge.

As the cleanest fossil fuel there is, using gas for power generation also provides a positive, environmentally friendly alternative – indeed since our operations began in 2007, Dolphin Energy's gas has helped minimise the carbon footprint, not to mention the billions of dollars that would have otherwise been spent buying alternative fuels required for power generation.

How Some of these Challenges are Being Met

It is clear that many efforts have been undertaken to meet the challenges associated with energy demand which will grow up to more than 40,000 MW by 2020. Projects to source more gas are in development and the UAE energy mix is in the process of change.

From our own perspective, we will continue to seek additional volumes of natural gas to help meet the increases in demand. We are already working closely with Qatar Petroleum (QP) on receiving those volumes and in QP we have a supportive, committed partner. By way of example we have worked closely with them to secure, for the second successive summer, volumes of diverted LNG – up to 400 million scf/day over a four month timeframe, during our period of highest demand. This is supported by utilising the skills of our employees, our contractors and the use of best in class technologies to help maximise the export volumes to the UAE.

> Two thirds of the gas consumed in Abu Dhabi is currently used to maintain and enhance oil production

One area that needs addressing as a matter of urgency is energy efficiency along with the link between subsidised pricing and wasteful energy practices. An honest conversation about the real costs of electricity and water generation – which according to the Regulation and Supervision Bureau sees the Abu Dhabi government bear nearly 85 per cent of electricity production costs for the Emirati population and over 50 per cent for expatriates – could lead to a change in behaviour.

There have been some excellent programmes designed to raise awareness about the need to be efficient. One thinks of the efforts of both the Emirates Environmental Group and the Environment Agency Abu Dhabi. In addition, the UAE Ministry of Energy is introducing new ways to engage people in the need to preserve water and electricity. The Emirates Conservation Prize is an excellent initiative which is likely to have a positive impact.

The International Energy Agency (IEA) estimates that US$8 trillion will need to be invested across the globe on new energy efficiency. Of this, US$169 billion is within the Middle East region according to the Agency. Closer to home, the Dubai Electricity and Water Authority has been set a target to achieve a drastic reduction in electricity consumption – 30 per cent below the projected business as usual demand by 2030.

Conclusion

The UAE energy mix is on course to change due to the increase of renewable energy and the introduction of nuclear energy. Nevertheless natural gas will still play a prominent role in a future energy mix.

However, what is striking about efforts to increase energy security is a spirit of cooperation and support, harnessed by a common purpose to develop an integrated solution to help meet the demands for energy. And it is this commitment, the sense of responsibility and the utilisation of skills and other resources that is being harnessed and is creating a groundswell that will help raise awareness about the need for energy efficiency and in time change behavior. I believe we are well set for the challenges ahead. ■

ADGAS announced it planned to increase production to as much as **2.4 billion** scf/day by 2017 by expanding its current facilities.

> The value of natural gas is illustrated by the launch of projects recently and the link gas provides to a low carbon economy

ABOUT IBRAHIM AHMED AL ANSAARI



He is the Chief Executive Officer of Dolphin Energy Limited, responsible for the direction of the company and its activities in the UAE and Qatar. Prior to his current position, Mr Al Ansaari was the company's General Manager in the UAE and previously served as Executive Vice President – Operations.

MOHAMMED BIN RASHID AL MAKTOUM SOLAR PARK

> (...) a 100MW photovoltaic plant that will operate as an Independent Power Producer constructed under the Build, Own, and Operate model

Solar Energy in Dubai is no longer a dream, it is a reality and is becoming increasingly prevalent across the Emirate. The main reason for this is the Mohammed bin Rashid Al Maktoum Solar Park. With a planned investment of AED 12 billion, by 2030 the solar park will have a capacity of 1,000MW, generating 5 per cent of Dubai's total power output with solar energy. From this point onwards, the solar park will annually displace 1 million tonnes of carbon dioxide emissions.

On 22 October 2013, HH Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, inaugurated the first phase of the Solar Park at Seih Al Dahal, located near the Dubai to Al Ain road, which is linked directly to Dubai Electricity and Water Authority's (DEWA's) power grid. This first phase uses photovoltaic technology to produce 13MW and generates approximately 24 million kilowatt hours of electricity annually. It has been awarded the Power Project of the Year award in the GCC by MEED Quality Awards for Projects 2014. During the launch, His Highness also initiated the second phase, a 100MW photovoltaic plant that will operate as an Independent Power Producer constructed under the Build, Own, and Operate model. DEWA will retain a 51 per cent share of the second phase, which is due to be operational by May 2017.



A range of projects will follow that will also see the inclusion of other solar-energy technologies generating power for Dubai. The ongoing development of the solar park is directly contributing to the achievement of the vision of HH Sheikh Mohammed bin Rashid Al Maktoum to promote Dubai's sustainable development. It complements the Dubai Integrated Energy Strategy 2030, which is aligned with the strategy of the Government of Dubai, placing energy sustainability and security amongst its key objectives to promote sustainable development. The strategy aims to create an urban infrastructure with sustainable resources for the Emirate of Dubai, provide clean-energy solutions to efficiently meet the needs of both present and future generations, and develop a low-carbon economy. The Mohammed bin Rashid Al Maktoum Solar Park is a leading example of sustainable development by generating renewable energy from solar power. It will include three additional features within its scope of operations: an innovation centre, a solar energy test centre, and an energy academy.

The first is a comprehensive innovation and research centre that supports the promotion of renewable-energy technologies and energy efficiency. The second is a solar testing facility and the third is a renewable-energy academy for training staff, to prepare future generations to learn and pioneer advances in solar-energy technologies.

Research, development and innovation are key components for driving DEWA's vision to promote sustainability in energy supply, achieve diversification of energy resources, and promote innovative, effective and environmentally-friendly initiatives. It also complements Dubai's goal to build a knowledge-based economy.

DEWA's research, development and innovation centre will be the research hub for its sustainability plans and efforts to become a global leader in renewable energy. The centre will boost the efficiency of DEWA's core activities and allow the introduction of the latest renewable-energy technologies. The R&D centre is intended to encourage innovative value-adding projects, ensure efficient deployment of existing renewable-energy technologies, conduct screening of industrial and social needs, and host performance testing for scientific solar and renewable-energy research.

The solar-testing facility at the solar park will test a range of photovoltaic, and concentrated solar-power technologies (potential technologies include solar troughs, solar-power towers and Stirling dishes) to optimise the performance of solar power systems. It will also test other innovative solar-energy technologies, such as energy-storage technologies, inverters, and supervisory control and data acquisition (SCADA) systems. The staff at the facility will compare their performance and provide detailed comparisons between different photovoltaic module technologies under identical conditions. They will be tested for their performance and long-term stability against a range of meteorological conditions. This will help identify the best systems and practices, and optimise power output and efficiency to position Dubai as a global leader in solar energy.



> The Mohammed bin Rashid Al Maktoum Solar Park is a leading example of sustainable development by generating renewable energy from solar power

The energy academy has two key objectives. The first is to be an educational institute and knowledge repository dedicated to solar energy. The second is to encourage sustainable Emiratisation. DEWA is working to strengthen Emiratisation in the public sector, enabling Emiratis to handle specialised jobs in different fields, to become experts in renewable energy. DEWA and US-based First Solar are working together to train UAE Nationals in solar-power technology to build a future cadre of engineers who will work on solar power in Dubai.

These initiatives are valuable contributions towards enhancing energy efficiency and supporting renewable-energy projects, particularly solar energy. They also play a major role in consolidating Dubai's position as a global hub for trade, finance, tourism, and the green economy, and as a global model in energy management, efficiency and sustainability. ■

> It will include three additional features within its scope of operations: an innovation centre, a solar energy test centre, and an energy academy

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CARBON CAPTURE USE AND STORAGE IN THE UAE

ARTICLE

By Paul Crooks

> For a community of 30,000 people, a shift from the practice of sending food scraps to landfills [would provide] enough electricity to power 25 homes

ADNOC and Masdar are developing the Middle East's first carbon capture use and storage (CCUS) facility. The joint venture is estimated to cost Dh 450 million and is expected to sequester up to 800,000 tons of carbon dioxide (CO_2) each year emitted as part of the manufacture of steel by Emirates Steel Industries. The CO_2 will then be utilized for enhanced oil recovery. The project positions ADNOC and Masdar as pioneers in the technology and provides a pathway to successfully address climate change concerns while allowing for continued large scale production of fossil fuels.

Announced in 2011, construction of the project is currently underway and scheduled to finish in 2016. The design and build process are being led by the Dodsal Group. Upon completion, the carbon capture facility will capture CO_2 from the Emirates Steel's (ES) plant near Mussafah in Abu Dhabi. The gas will then be compressed and dehydrated for transportation via a 50km pipeline to an ADNOC onshore oil field in Rumaitha. At destination, the CO_2 will be used as a substitute for the natural gas methane, to boost yields in production from the oil field (a process commonly referred to as enhanced oil recovery). Swapping the injection of natural gas for CO_2 will have the twin benefits of taking significant amounts of CO_2 out of the atmosphere, as well as freeing up greater amounts of natural gas for utilization in power generation, water desalinisation or transportation. In pursuing CCUS, ADNOC and Masdar are looking to help address climate change while also delivering a positive economic and environmental return.

The project is only one of 15 hydrocarbon recovery CCUS schemes currently underway in the world, which underscores the United Arab Emirate's (UAE) role in energy leadership and innovation. While various components of carbon capture and storage (CCS) technology have existed for many years, their combination and large-scale use have proved challenging. A key strength of the ES CCUS project is that it builds on a strong base of existing knowledge, with collaboration between Masdar and ADNOC in piloting methods of CO_2 oil field injection dating back to 2009. The ES scheme has also reinforced Abu Dhabi's profile as an emerging hub for CCS and CCUS expertise. In November 2013, over 50 experts gathered at the Masdar Institute for a United Nations backed meeting on the prospective economic return offered by investments in CCS across Western Asia.

The UAE's embrace of CCUS shows its commitment to reduce its carbon footprint without compromising its oil and gas production. The International Energy Agency stated that in the power and industrial sectors alone, CCS will need to provide up to one-fifth of all carbon mitigation by 2050. In CCUS, Abu Dhabi has found a way of helping address climate change while creating positive economic and environmental returns. In this way, it is already ensuring a more sustainable domestic energy future, while acting as a steward for global environmental awareness. ■

ABOUT PAUL CROOKS



He is the Masdar CCS Senior Project Manager heading up development of the first ADNOC/Masdar Joint Venture Abu Dhabi CCS Project.



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FEED A DISPOSER ... STARVE A LANDFILL

ARTICLE

By Mohamed Karam

> For a community of 30,000 people, a shift from the practice of sending food scraps to landfills [would provide] enough electricity to power 25 homes



As per a 2012 report from the World Bank, the GCC countries, and especially the UAE, have some of the highest per capita food waste in the world. Most of the large quantities of food waste are disposed of, and left to decay, in landfills. In a region with an already large overall carbon footprint, food waste compounds the issue with the release of large amounts of methane, a greenhouse gas 25 times more potent than carbon dioxide. Efficient food waste management is therefore an important practice that can help reduce the overall greenhouse gas footprint of the country.

Food waste disposers are considered a key method in responsible food waste management. Disposers offer a practical, convenient and environmentally sound approach to the growing problem of food waste. Some of the advantages of using food waste disposers are low water consumption per household (about 1 per cent or less of a household's total water consumption) and low associated costs on average (less than a dollar per month in electricity usage).

Disposers divert organic waste from landfills that could create ground water contamination, such as from methane gas emissions and leachate. In communities with treatment plants, disposers enable organic waste to be treated rather than landfilled. At these plants, food waste can be recycled to produce renewable energy, while biosolids, a byproduct of the treatment process, can be converted into fertiliser. This system turns waste, the world's most pervasive and overlooked local energy source, into fuel. In this process, households become both the producer and consumer of locally sourced energy supplies.

The potential alternative for food waste disposal is composting. Composting is the least expensive method with the lowest footprint, but can be difficult to undertake on a large scale, especially in dense urban areas, such as residential developments in the UAE.

A Life Cycle Assessment (LCA) undertaken by InSinkErator in 2013 shows that for a community of 30,000 people, a shift from sending food waste to landfills to sending most of it to the local wastewater treatment plant through in-sink disposers, would provide enough electricity to power 25 homes for a year. Municipal planners, when taking a holistic view of all the options for managing food waste, find that landfill has the highest economic cost and carbon footprint among all food waste disposal practices. On the other hand, using food waste disposers, underground sewers and a modern wastewater facility with anaerobic digestion is less expensive, with a more modest carbon footprint. ■

DID YOU KNOW?

The global warming potential of disposing of food waste using a FWD unit with treatment at a wastewater treatment plant is always less than the carbon footprint of disposing food waste in a landfill. However, the carbon footprint of the landfill is primarily related to non-captured landfill gas (methane). If all of the landfill gas is captured, the landfill scenario is in the same range as the extended aeration wastewater treatment scenarios. However, even with 100 per cent gas capture, the landfill has a higher GWP burden than the other options, assuming there are no emissions-control technologies at the landfill.

ABOUT MOHAMED KARAM



He is the Business Development Manager for the Middle East and Africa (MEA) InSinkErator.

Mohamed has over 18 years of experience working as an expert and proficient brand builder across key industry verticals.

THE UAE'S GREATEST UNTAPPED ENERGY RESOURCE: ITS PEOPLE

ARTICLE

By Alex Laskey

> (...) the UAE is seeking to improve energy demand efficiency, to close the energy supply gap by up to 40 per cent by 2030

It's looking more and more likely that history will remember 2014 as a crossroads on climate change. In March 2014, the world's leading climate scientists told the world that there's simply no more time left to waste: nations must act quickly, decisively, and cooperatively if we want a decent shot at averting the worst effects of a warming planet. It wasn't the first time that the scientific community delivered their warning, but it could be the last. The next report will not arrive until the next decade, when we may have already passed critical tipping points.



It's in this context that the UAE is seeking to improve energy-demand efficiency, to close the energy supply gap by up to 40% by 2030. Those targets – and the steps the seven Emirates are undertaking – carry profound implications for our own future and for generations to come, which means we need to get creative.

There's no doubt that more renewables and stronger energy-efficiency standards will form the backbone of any climate framework going forward. But putting all our efforts into just those mandates, which primarily focus on a few large stakeholders such as buildings and the commercial sector, would ignore what's shaping up to be the 21st century's most powerful energy resource: People.

Historically, our society has done a poor job of engaging a broad base of voices in conversations that matter. That's true of the discourse around energy and climate, which is mostly dominated by business stakeholders and policymakers. But now, with great leaps in technology, this is changing.

Take Wikipedia, for example. The world's premier source for information-on-demand was built not by a handpicked stable of experts, but by millions of engaged citizens equipped with facts and an Internet connection. The result is a body of knowledge that's more diverse and dynamic than any in human history. And it's free for everyone.

With Twitter, everyday citizens have the power to break news. Sites like Yelp and Amazon have made all of us critics. When disaster strikes, it's not just relief professionals who deliver aid anymore. It's also ordinary people, united by a common cause, with the tools to organise. No matter where you look, participation is democratising.

So what of climate strategies? Until now, the UAE's approach to cutting emissions has been aimed squarely at centralised polluters – and it has achieved much. But there are millions of citizens who care deeply about climate change, and they're ready to put their shoulders to the wheel.

> Until now, the UAE's approach to cutting emissions has aimed squarely at centralised polluters

Technology, economics, and science are aligning behind them. Utilities worldwide are looking for new ways to empower their customers to use less energy. And they're finding success in surprising ways, such as behavioural science techniques. For example, showing people how much energy they consume compared to their neighbours, then giving them personalised advice on how to use less, has emerged as an inexpensive and profoundly effective energy-saving solution.

It's an example of a nudge. And thanks to advances in cloud-based platforms, big data and behavioural science, it's now possible to nudge millions of people all at once. At Opower we've seen the results, with families worldwide starting to turn off unnecessary lights and turn down the heat when they leave home. The climate impact is substantial. So is the financial one – globally, utility customers have already saved more than US$475 million through approaches like this.

So that's good news. And it will be even better news if more people can join in. Whether they get the chance depends on what role behavioural energy efficiency plays in the national and Emirate-level policies and frameworks. As regulators weigh their options for 2030, they would be wise to remember that our greatest energy resource isn't always new infrastructure, or even cleaner technology. It's people themselves. And they're ready to participate. ■

> As regulators weigh their options for 2030, they would be wise to remember that our greatest energy resource [are the] people themselves

ABOUT ALEX LASKEY



He is responsible for Opower's business strategy, public profile, and company culture. He leads and develops Opower's partnerships with utilities and governments, including the company's international expansion on three continents Alex also serves on the board of the Conservation Lands Foundation.

WETEX 2014 – AT THE FOREFRONT OF SUSTAINABILITY

> More than 1,500 companies, ministries, government organisations, public-welfare associations, and educational institutions took part in WETEX 2014



The Water, Energy, Technology, and Environment Exhibition (WETEX) has now been running for 16 years, under the directive of HH Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, and under the patronage of HH Sheikh Hamdan bin Rashid Al Maktoum, Deputy Ruler of Dubai, Finance Minister of the UAE and President of Dubai Electricity and Water Authority (DEWA). The event's theme for 2014 was 'At The Forefront of Sustainability,' and set new records for both participation and attendance.

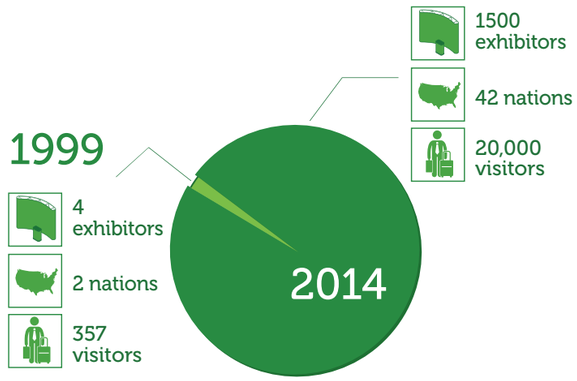
More than 1,500 companies, ministries, government organisations, public-welfare associations, and educational institutions took part in WETEX 2014 showcasing innovative solutions to rationalise electricity and water consumption at the Dubai International Convention and Exhibition Centre (DICEC).

Since the first show in 1999, with 2 represented nations, 4 exhibitors and 357 visitors, WETEX has grown from success to success. This year recorded over 20,000 visitors, with 1,500 exhibitors and 42 nations represented from around the world.

Today, WETEX offers a unique business platform by focusing on the latest technologies and practices. These cover a range of sectors, including water, electricity generation, advanced power-management solutions, energy, environment, and oil, gas and clean coal, in addition to advanced power management solutions. It also serves as an ideal venue to exchange expertise between



WETEX grows from success to success



governments and decision-makers to exchange expertise on to cope with the latest trends in energy, water and environmental issues. As a result, it attracts a wide range of experts and specialists.

DEWA ran its first Green Week this year, which saw participation from numerous public and private educational institutions, as well as DEWA's Corporate Social Responsibility representatives and Sustainability Ambassadors. DEWA will run Green Week as an annual event to serve as an umbrella

> Today, WETEX offers a unique business platform by focusing on the latest technologies and practices.



under which a series of community events will be held, promoting green best practices in Dubai. Moving forward, DEWA will organise a series of social activities and events during Green Week to further promote the importance of spreading a sustainability culture, as well as facilitate discussions on sustainability topics.

These will cover the that focus on challenges such as green energy, green footprint, green buildings, green economy, waste management, reducing consumption of electricity and water, as well as other topics relevant to a broad section of the community. One example of this is DEWA's Green Ribbon sustainability pledge campaign, which proved popular among exhibition visitors during the first three days of Green Week. Over 1,200 people took part in the campaign, which demonstrated the growing social awareness about green and sustainable lifestyles by the citizens and residents of the Emirate of Dubai as well as among international energy and water industries.

The 16th WETEX was the largest ever, occupying more than 47,000 square metres of space at DICEC. It witnessed a growing number of sponsors with 16 Strategic, 10 Platinum, and 32 Gold sponsors from the environment, energy, water, electricity, and oil & gas sectors from across the region and the world.

The exhibition saw participation from prominent government organisations including, in addition to DEWA and the Dubai Supreme Council of Energy, the Abu Dhabi Water & Electricity Authority (ADWEA), Federal Electricity & Water Authority (FEWA), Sharjah Electricity & Water Authority (SEWA), UAE Ministry of Environment and Water, Ministry of Energy, The Roads and Transport Authority (RTA), Dubai Municipality, Emirates Global Aluminium, Zayed International Prize for the Environment, Department of Dubai Civil Defence, Mohammed bin Rashid Establishment for SME Development, Drydocks World, Hamriyah Free Zone, Municipality & Planning Department – Ajman, Fujairah Municipality, The Department of Planning and Development of the Ports, Customs and Free Zone, Department of Municipal Affairs – Al Ain Municipality, Friends of the Environment Society, Emirates Environmental Group (EEG), Friends of Environment Society, International Centre For Agriculture (ICBA), Emirates Science Club, Environmental Centre for Arab Towns, Environment Agency and Natural Reserves, Abu Dhabi Sewerage Service Company, and from the GCC, Qatar Electricity and Water Company. ■

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HASSYAN CLEAN COAL POWER PROJECT

Part of DEWA's commitment to the Dubai Integrated Energy Strategy 2030 is the introduction of clean coal to generate 12 per cent of Dubai's total power output by 2030, to diversify DEWA's present gas- and oil-fired electricity output. The power output of phase one of the Hassyan clean coal plant will be 1,200MW net, consisting of two units, with the first unit to be commercially operational by March 2020, and the second unit in March 2021. DEWA has initiated this strategic move for Dubai by investing in technology that will be operated based on the Independent Power Producer (IPP) model at Hassyan. DEWA is planning two further phases of clean coal plant (phase 2 and phase 3), each of which is intended to have a net capacity of 1,200MW, bringing the total power output from clean coal at Hassyan to 3,600MW. Each phase of the power programme will use the IPP model.

The plant will be safe, economically attractive and offer increased operational reliability and lower outage rates. The design will incorporate a high level of effective long-term operation to achieve high availability, by incorporating back up equipments and components with a design life of not less than 25 years.
The plant will be located in Saih Shuaib, on the coast of Dubai, close to the border between the emirates of Dubai and Abu Dhabi. The location is a Greenfield site with no previous history of industrial use.



Phase 1 Plant Detail

The plant will consist of two equally-sized coal-fired power units. Each power unit will comprise of one steam generator, one steam turbine with electric generator and associated auxiliary equipment and facilities.
The maximum net power capacity of an individual power unit at the electrical delivery point will not exceed 600MW and the plant will be based on proven supercritical or ultra-supercritical technology.
The plant will be designed to be capable of producing power from either clean coal or a backup fuel without any limitation on the duration of operations on either fuel. Backup fuel will be used to start-up of the power units. The plant will have the following features:

- An indoor coal-storage area at the plant
- A Selective Catalytic Reduction (SCR) system to remove nitrogen oxide (NOx).
- A Flue Gas Desulphurisation (FGD) system to remove sulphur dioxide (SO2).
- A particulate removal system (electrostatic precipitator or fabric filter) system will be supplied for removal of particulate matter (PM).
- Sufficient space in the plant layout for future retrofit of post-combustion carbon-capture technology. ■

06
TRANSPORT & MOBILITY

HIS EXCELLENCY
MATTAR AL TAYER

CHAIRMAN OF THE BOARD & EXECUTIVE DIRECTOR OF THE ROADS AND TRANSPORT AUTHORITY (RTA)



In line with the Green Economy initiative announced by H.H. Sheikh Mohamed Bin Rashid Al Maktoum and the Dubai Energy Strategy 2030, the Roads and Transport Authority Dubai (RTA) are delighted to publicly announce our strategy on energy management, sustainability and green approaches in the field of transportation.

RTA, in line with its vision and mission, which is aligned with the Dubai Integrated Energy Strategy 2030, is responsible for providing an integrated transportation system, with energy and environmental sustainability being a key consideration. This is confirmed in one of our key strategic objectives: Achieve environmental sustainability for transportation.

Energy is a critical component in RTA's operations and one that has significant costs and environmental benefits. Whilst working to continually deliver cost-effective solutions for our stakeholders, we are at the same time an environmentally conscious organisation on a mission to attain sustainability excellence through energy efficiency.

Noteworthy is that RTA Dubai recently became the first transport authority in the Middle East and Africa region, and the first leading entity of the Dubai Government, to achieve Energy Management System Certification against the ISO 50001:2011 International Standard. This added yet another major milestone in our journey to position RTA as a leader in implementing the highest global standards of corporate sustainability.

Consistent with our policies, RTA is committed to:

- Continuing to identify and implement initiatives, projects and practices that can enhance energy performance.
- Monitor and evaluate practices that drive improved energy efficiency and sustainability through innovation, smart thinking and continuous improvement.

In summary, RTA strives to develop and promote public-transportation solutions as a mode of choice at a level that will exceed community expectations and satisfaction, to enhance the liveability and sustainability of Dubai as a global city, and at the same time, through this integrated approach to strive to save energy for future generations.

Let us work together towards achieving the green vision of Dubai.

AN OUTLOOK ON TRANSPORTATION AND MOBILITY IN THE UAE

OFFERING THE OPTION FOR A MORE SUSTAINABLE FUEL SOLUTION



MAIN REPORT

By Eng. Faris Saif Al Mazrouei

The UAE is one of the global leaders when it comes to transport infrastructure. It has been ranked as one of only 17 countries in the world boasting 100 per cent paved roads, according to data by the World Economic Forum. Coupled with thriving seaport and aviation infrastructure in key emirates, the country ranks 11th overall in terms of the availability of quality transport infrastructure.

As transport infrastructure is of key importance for economic development, the country is well positioned to continue reaping the benefits of its earlier decisions to invest in world-class transport facilities. Still, the sector is changing fast, with the most significant global trend being an increased demand for infrastructure and facilities.

Globally, vehicle fleets are set to increase from around 800 million currently, to between two to three billion by 2050, according to the World Economic Forum. In aviation, the International Air Transportation Association is also projecting large-scale change within the same time frame. Air transport alone will reach 16 billion passengers, compared to approximately 3 billion in 2012.

The expected rapid growth in demand for transport services shows the need for continued investment to expand infrastructure and fleets but also, more than ever before, poses the question of environmental performance within the transport sector. In 2011, transport accounted for 22 per cent of global greenhouse emissions, with the sector being the second-largest source of man-made carbon emissions, behind the energy sector. Governments all over the world are re-thinking transport infrastructure with environmental considerations in mind, and the UAE is no exception.

The country's world-class network of high-speed roads and highways and the availability of cheap fuel have led to a steady increase in private vehicles on the roads. While private-car ownership will continue to be strong, the country is upgrading its public-transport network, providing alternative safer and cleaner ways to transport passengers and goods.

For the first time, the UAE is investing in a rail network, which will connect important industrial areas and cities throughout the country. To be built in stages, the railway will eventually cover 1,200 kilometres, connecting areas on the border of Saudi Arabia and those bordering Oman. The network will run from Ghweifat, in the Western region to Abu Dhabi, Dubai and the Northern Emirates. It will also offer connections with Al Ain and Madinat Zayed, as well as important transport and industrial facilities such as Mussafah and Khalifa Port in Abu Dhabi, Dubai's Jebel Ali Free Zone, the Port of Fujairah and Saqr Port in Ras Al Khaimah.

Stage one of the railway will be 264-kilometres long, connecting Shah and Habshan with Ruwais. The Habshan-Ruwais section of the network has been undergoing testing since September 2013, and services are expected to start before the end of this year.

Etihad Rail has been developed based on the latest international standards and will help transport people and goods in a safer, more environmentally friendly manner. Because of increased efficiency, it will help reduce greenhouse gases by more than 2.2 million tonnes annually. Efforts have been made to ensure its construction is causing minimal environmental impact and will be operated to the highest environmental, health and safety standards.

Besides providing connectivity within the UAE, Etihad Rail will eventually serve to connect the country with its neighbours. It will form a vital part of the planned GCC railway network linking Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the UAE.

Significant efforts are also being made by some emirates to increase the availability of public transport options within cities.

In Abu Dhabi, the Surface Transport Master Plan was commissioned in 2008 by the Department of Transport in order to implement a comprehensive and sustainable system of diverse mobility options. The plan provides a holistic strategy for high-speed highways, freight rail, regional rail, maritime and aviation transportation, including a call to action for infrastructure investments to keep pace with the country's projected growth in the coming years.

Initial feasibility studies suggest that the population of Abu Dhabi alone will reach 3.1 million by 2030, with close to 8 million tourists and an average of 5.4 million personal trips per day. To reduce congestion on the roads and the irreversible impact on the environment, various forms of transportation will be required, connecting cities through modes that are easily accessible for the public. Bus transportation is one option which encourages people to leave private vehicles. The Department of Transport has made significant efforts in creating and upgrading the bus network and, as of 2011, is operating 650 buses on more than 95 routes.

Abu Dhabi is also progressing with plans to develop its own metro system, following the success of Dubai. Phase one of the Abu Dhabi Metro project is expected to cover a distance of 60 kilometres.

Dubai is also making significant investments in new transport infrastructure. In November, the Emirate is expected to launch the Dubai Tram, connecting the densely-populated area

between Dubai Marina and Umm Suqueim Road. The first phase of the project will have a 10.6-kilometre-long track with 11 trams running through 17 stations. Another 14 trams are to be added in the second phase of the project.

The Emirate is also continuing to upgrade its metro system, which has served millions of passengers since it was first launched in 2009. In February, the Road & Transport Authority announced that it will double in length Dubai Metro's green line. Its red line will also increase by 12 stations. By 2020, the network will have 70 stations, compared to the current 47, and its total length will reach 110 kilometres.

The metro extension is one of several projects undertaken to accommodate expected visitor flows ahead of Expo 2020. World expos initiate a flurry of investment activity in the infrastructure development of the host city. The Chinese government, for example, invested over US$40 billion on honing Shanghai's infrastructure ahead of Expo 2010, introducing six new metro lines, roads, tunnels, bridges and a high-speed rail link to its existing system.

Dubai too, has allocated a substantial portion of its expo budget to building and developing transportation and logistics infrastructure. According to analysts, Dubai Expo 2020 is likely to generate approximately US$23 billion between 2015 and 2021,

> For the first time, the UAE is investing in a rail network, which will connect important industrial areas and cities throughout the country

and it is projected to boost Dubai's economic growth to an average of 6.4 per cent a year from 2014 to 2016, and potentially to 10.5 per cent by 2020.

Dubai sees the need to constantly hone its advantage as a global transportation hub for passengers and cargo as part of an ongoing strategy, and in the years leading to the expo, the government has committed to invest billions of dollars to expand its existing airport and port infrastructure. Dubai International Airport is currently ranked as the second-busiest airport in the world by international passenger traffic and is already an important contributor to Dubai's economy. DIA is currently undergoing an expansion costing US$7.8 billion, including the construction of concourse 3 and concourse 4 and expansion of terminals one and two.

At the end of 2013, Dubai inaugurated Al Maktoum International Airport (AMIA), which, with a capacity to handle 160 million passengers per year, will be the world's largest airport once fully operational. The development of AMIA includes the creation of integrated sea freight and airfreight capabilities that are expected to boost Dubai's general transportation infrastructure during, and after, Expo 2020.

Jebel Ali port is also set to grow in importance in the coming years, with its proximity to Dubai World Central and the expo site. The port is already a crucial global channel for trade, and, in the future, it will act as a passage for the transfer of goods to the expo site.

Entities in both Abu Dhabi and Dubai are continuing to explore the potential of new technologies to reduce the environmental impact of the transport sector.

In January this year, Etihad Airways, together with plane manufacturer Boeing, conducted a demonstration flight powered in part with biofuel. This was the first time biofuel produced in the UAE was tested by the company. Etihad and the American planemaker are also participating in a partnership with the Masdar Institute of Science and Technology and Honeywell, in the Sustainable Bioenergy Research Project, which aims to use locally-grown saltwater-tolerant plants to produce biofuel.

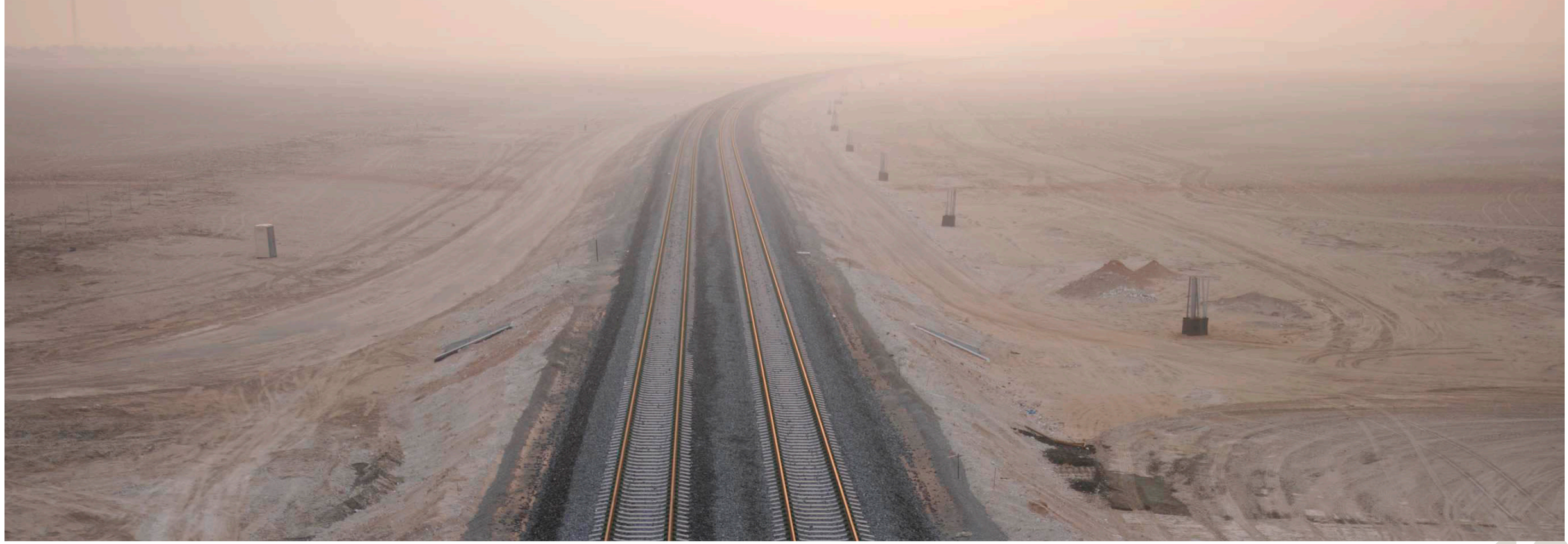
The Dubai Electricity and Water Authority, on the other hand, is working on a plan to provide charging stations for electric vehicles within the Emirate. Electric cars can use power supplied by carbon-free sources such as solar energy. Even if the electricity is obtained from fossil fuels, using it to power vehicles is more efficient than burning fossil fuels within car engines.

Looking forward, the future is paved with numerous opportunities for each Emirate within the UAE to refine its existing transportation networks, always keeping the quality of life of its residents in mind. Sustainability is no longer an add-on, but an in-built element of any federal initiative that aims to connect people, cities, and industries in a flourishing, liveable, and ultimately enjoyable urban environment that millions can proudly call home. ■

ABOUT ENG. FARIS SAIF AL MAZROUEI



He is the Acting Chief Executive Officer of Etihad Rail and is responsible for managing the overall construction and operations of the UAE's Rail network.



AN EFFICIENT AND ENVIRONMENTALLY FRIENDLY RAIL NETWORK

ARTICLE

By Eng. Faris Saif Al Mazrouei

Since its inception, Etihad Rail's mission has been to provide a safe and sustainable passenger and freight railway network in the country. Our aim is to offer a faster, safer, more reliable and more environmentally-friendly service than the transport systems currently available in the UAE.

Studies show that trains are one of the most environmentally friendly modes of transport. This will certainly be the case with Etihad Rail, which is being built in three stages and will eventually provide a link between the Western Region and the Northern Emirates.

> "Etihad Rail has built 10 camel underpasses, 22 underpasses for gazelles and 78 underpasses for reptiles in an effort to minimise disruption to wildlife habitats."



Once in operation, the railway will contribute to a reduction in traffic and resulting greenhouse gas emissions. This will have significant implications, especially when it comes to the transportation of goods, which is currently done primarily by truck. A single freight train can carry the load of up to 300 trucks, reducing road congestion and accidents. When fully loaded, a train produces up to 80 per cent less carbon-dioxide emissions than the equivalent trucks.

Trains operating on the line will adhere to the Tier 3 engine-emissions standards set by the Environmental Protection Agency in the United States. These standards mandate emissions produced by locomotives and control nitrogen oxide, sulphur oxide, volatile organic compounds, particulate matter and carbon monoxide levels.

Based on forecasted traffic volumes, the Etihad Rail network will reduce greenhouse gases by more than 2.2 million tonnes annually – the equivalent of removing 375,000 vehicles from the roads or planting 52 million trees.

While the rail system will offer environmental and social benefits once it is functional, our team is also evaluating and mitigating the environmental impact of constructing the network.

A dedicated Health, Safety, Environment & Quality department is responsible for protecting the environment, minimising occupational and public health and safety risks and ensuring the highest standards of performance and quality systems.

As per Abu Dhabi's regulations, Etihad Rail has carried out Environmental Impact Assessments (EIAs) to estimate the detrimental effects of construction activities and manage them effectively. We are delivering the EIAs in three stages, matching the three delivery stages of the railway network. Stage one of the railway covers the distance between Shah and Habshan to Ruwais. Stage two connects the Emirate of Abu Dhabi with Jebel Ali in Dubai, with additional connections to Mussafah, Ghweifat and Al Ain. Stage three is linking the rest of Dubai, Sharjah and the Northern regions.

EIA reports for stages one and two of the network have already been compiled, addressing various components such as air quality, waste management, geology, soil and groundwater, terrestrial ecology, noise and vibration, and visual and cultural heritage. To commence the EIAs, we established the environmental baseline for each relevant component through extensive site walkovers, detailed terrestrial ecological surveys and a long-term air-quality and noise-monitoring programmes.

The reports have been submitted to the Environment Agency – Abu Dhabi and other relevant authorities in the Emirate. For stage three of the project, Etihad Rail will conduct separate EIAs to be submitted to the regulatory authorities of each Emirate along the route.

In terms of managing the negative impact of construction and operation activities, so far, the EIA process has enabled us to identify areas of particular importance such as wildlife-nesting sites and avoid them where possible. Etihad Rail has built 10 camel underpasses, 22 underpasses for gazelles and 78 underpasses for reptiles in an effort to minimise disruption to wildlife habitats.

Waste management is another important issue and we are developing a waste-management plan for the construction and operation phases of the railway. This will ensure waste is segregated, re-used and recycled where possible, diverting it from landfill.

Noise pollution is another concern for our team, especially after the network starts operation. The train tracks use modern technology that does not require joints, thus reducing noise impacts. We have also taken measures to select locomotives that operate with low noise levels.

In conclusion, Etihad Rail is taking significant steps to ensure it offers a sustainable option for the transportation of goods and passengers across the UAE. The network will connect the country's key centres of trade, industry and population, acting as a catalyst for further economic growth and sustaining social development. ■

ABOUT ENG. FARIS SAIF AL MAZROUEI



He is the Acting Chief Executive Officer of Etihad Rail and is responsible for managing the overall construction and operations of the UAE's Rail network.



INTERVIEW

INTERVIEW:

HE MATTAR AL TAYER

Chairman of the Board and Executive Director, RTA

هيئة الطرق والمواصلات
ROADS & TRANSPORT AUTHORITY

RTA

The RTA has already announced its alignment with the UAE's vision for a green economy, revealing various energy-efficient projects in the pipeline – from traffic signals and street lighting powered by LED technology, to fuel-efficient low-emission vehicles. Can you outline RTA's objectives and goals for introducing these measures in Dubai?

HE Mattar Al Tayer: In line with Dubai Government's directions, RTA, as the entity responsible for transport in Dubai, will continue to demonstrate its commitment towards energy conservation and the green economy. RTA is committed to integrating environmental and energy considerations into its strategic planning and adopting lower-impact alternatives where feasible. It will seek to integrate mitigation measures in its planning processes for land-transportation systems, particularly where environmental impacts associated with transport systems are considered to carry a negative impact for nature and society.

This commitment strengthens RTA's position as a leading government entity in the implementation of the Dubai Energy Strategy 2030, and helps meet the expectations of HH Sheikh Mohammed bin Rashid Al Maktoum's vision for a green economy for sustainable development. As such, RTA always meets and exceeds local and international standards. For example, the institution's adherence to ISO50001 ensures a systematic approach to improvements in the efficiency of energy utilisation.

What role can transportation play in a green economy? What untapped potential does this sector hold?

HE Mattar Al Tayer: RTA's vision and mission are aligned with the Dubai Integrated Energy Strategy 2030, and together, seek to provide an integrated surface-transportation system, built around principles of energy efficiency and environmental sustainability. This is explicitly expressed in one of our strategic objectives: achieve environmental sustainability for transportation.

As energy plays a vital role in both the green economy and environmental sustainability, RTA seeks to align its policies with these objectives. The organisation explores all possible opportunities to utilise renewable energy in its projects. A successful example of this is solar car-parking meters. We also continue to integrate best-practice efficiency technologies in our buildings and facilities to minimise water and electricity consumption. RTA supports the green-economy principles across all projects, helping promote sustainability in transportation and urban planning.

> As energy plays a vital role in both the green economy and environmental sustainability, RTA seeks to align its policies with these objectives.

According to recent reports, over 2 million cars run on Dubai's roads daily. How can a strong and interconnected public transport system help reduce residents' reliance on private transport? How do you see this contributing to reducing the Emirate's carbon footprint?

HE Mattar Al Tayer: With the various initiatives and projects launched by the RTA since its inception in 2006, the public transport share has increased from 6 per cent to 12 per cent in 2013, and is expected to reach 14 per cent by the end of this year. RTA strives to achieve a 20 per cent figure by 2020. The number of passengers using public transport (Dubai Metro, public buses, marine transit modes and taxis) in the first half of this year exceeded 262 million, compared to approximately 165 million passengers during the same period last year.

This sustained growth has been achieved thanks to a high-performing, integrated mass-transit network comprising the Dubai Metro, a modern fleet of public buses and marine transit (traditional abras, water buses, Dubai Ferry, and the water taxi). The last quarter of this year will witness the launch of the Dubai Tram. This further extension to the public transit system will serve residents in an area of high population density and act as a hub for visitors throughout the year.

The sustained increase in public transport use over a number of years is testimony to the fact that people are realising the effectiveness and reliability of the expanding public-transport system. This has, in turn, helped drastically reduce both car ownership and the Emirate's carbon footprint.

Other initiatives that have helped increase the public transport share include the introduction, in 2009, of the smart travel card known as "Nol", which enables commuters to pay for the use of RTA transport modes in Dubai with a single card, thereby making travel on public transport more convenient. Regular commuters can make use of a monthly pass and students can benefit from discounts, while people with special needs and senior citizens can travel on public transport free of charge.

In addition, RTA celebrates Public Transport Day on 1 November every year, and has done so for the past five years, to encourage people, especially new users, to try the public-transport system. RTA has witnessed a significant annual increase in passenger numbers on this day over the years.

RTA also recently launched a one-day travel pass for the water bus, where commuters can hop on and hop off for unlimited travel over a single day in Dubai Marina. Another effective initiative developed within Dubai is the introduction of the Sky bus, providing a direct express connection to the airport. The result of these services has been significant, as network coverage has increased to reach 85 per cent of Dubai and 100 per cent of the CBD area. With the addition of the Sky bus, visitors to Dubai have more options for reaching their destination from the airport, other options being the Dubai Metro and taxis.

Service levels are consistently reviewed to provide a better integrated system. Currently the average waiting time between the public buses and metro is about seven minutes.

RTA recently launched the Dubai Smart Taxi app which lets customers book a taxi by simply shaking their smartphone. This is helping generate more taxi journeys. Between mid-June and the beginning of July, some 20,000 people had downloaded the app, with 500 bookings made. As part of the smart-city initiatives, RTA is also integrating the Nol payment system with the taxi service, and more than 200 other services are being designed to be available on mobile devices by the end of 2015.

> The public transport share has increased from 6 per cent to 12 per cent in 2013, and is expected to reach 14 per cent by the end of this year

Can you outline the RTA's interest in investing in smart technology (mParking; Wojhati; smart taxis, multipurpose Nol cards)? How do each of these measures link to RTA's overall objectives?

HE Mattar Al Tayer: RTA is committed to investing in new, smart technology by leveraging internal and external capabilities of Cloud, Analytics, Social and Mobile. The upcoming Smart Parking application, the Smart Taxi, the Near Field Communication Nol cards and the Smart Public Transport applications all integrate technology with business solutions, to enable RTA customers to access services from anywhere, at any time, through a positive user experience. At the same time, RTA recognises the importance of social media and empowering customers. For that reason, social collaboration is at the top of RTA's agenda. Being able to ask and obtain real-time feedback across multiple channels, and being able to analyse the data and provide the public with a meaningful response is extremely valuable. We make use of the latest technology for social-media interaction analysis and customer relationship management tools.

All the business and technical initiatives set out above are in line with RTA's vision to enable safer, smarter and smoother transportation for all. RTA will continue to invest in new technology and is transitioning to a fully customer-centric business model, where all interactions with the public will be personalised, fast and efficient. RTA strongly supports Sheikh Mohammed's vision that the UAE Government should make the citizens happy at all times, and its actions are a result of such inspirational leadership. ■

Can you share an overview of RTA's plans for expanding public-transport networks for residents?

HE Mattar Al Tayer: RTA's plans in the coming time period can be summarised as follows:

- Completion of the Al-Sufouh Tram project by November 2014. The train will run for 14kms along Al-Sufouh Road. This will include 19 stations, with 25 trams operating, each capable of carrying 400 passengers
- Extension of the Dubai Metro red and green lines. In particular, the extension of the Metro green line towards Academic Village will undergo detailed study and concept design.
- Adding capacity to Dubai Creek crossings. In particular, a new crossing at Al Shindagha will undergo detailed study and concept design, with construction starting soon after.
- Further develop infrastructure for pedestrians and cyclists.
- Introduce the concept of transit-oriented developments around the metro stations.

> RTA recently launched the Dubai Smart Taxi app which lets customers book a taxi by simply shaking their smartphone.



ENERGY EFFICIENT DUBAI METRO

ARTICLE

By Abdulla Yousef Al Ali



The improvement of public-transport infrastructure and its reliability and sustainability is at the top of the Dubai Government's priorities. Since its establishment, RTA's vision of "Safe and Smooth Transport for All" led to the development of an integrated multi-modal public-transit system, which includes rail, marine and bus transit systems. RTA, through its strategic goals, is aligned with the Dubai Strategic Plan, with four out of eight of RTA's goals directly related to sustainability with an emphasis on environmental and energy issues.

The 76-kilometre long Dubai Metro was developed as part of a comprehensive rail-transit network, which is expected to accommodate the future needs of Dubai. The metro project is planned as part of the Strategic Integrated Master Plan, aiming at increasing the public-transport mode share from 6 per cent to 30 per cent by the year 2030. It is the world's longest fully-automated driverless metro network system. It is recognised for its substantial contribution to environmental protection, energy conservation, public-health improvement, and the economy of Dubai. There are two metro lines: the red line launched on 9 September, 2009 with the green line following on 9 September, 2011. Currently, all 47 stations on the red and green lines are in operation. Statistics up until March 2014 show that the metro carries an average of 451,374 passengers on a daily basis.

The Dubai Metro makes a clear contribution in terms of increased mobility within the Emirate, servicing 138 million passengers in 2013, and reducing the carbon footprint of the transport network by as much as 475 tonnes of CO2 per day. This is set to rise to 788 tonnes of CO2 per day by 2020. Other benefits emerging from the metro project include providing affordable public transport as an alternative to private vehicles, improving the traffic conditions in key areas by as much as 25 per cent, and increasing the value of properties near the metro track by between 20 – 30 per cent.

Furthermore, the increase in passenger numbers contributes towards greater energy efficiency per kilometre travelled. This was reflected in the 16 per cent efficiency with the use of traction power in 2013 (0.056 kwh/passenger km) as opposed to (0.067 kwh/passenger km) in 2012. Meanwhile, non-traction power reached 20 per cent efficiency in 2013 (1.36 (kwh/passenger) as compared to (1.70 kwh/passenger) in year 2012.

Dubai Metro, with a total electrical-connected load of 129,790 KVA, has developed an Energy Management Plan (EMP). The main objective of EMP is to control and minimise energy consumption and to meet the targets set out in the Operations Plan. The plan helps in procuring energy-efficient equipment and enables the continuous monitoring of energy usage. It is part of RTA's commitment towards a green city.

Additionally, the EMP contributes to minimising power usage, reducing the maximum power demand and maintaining the power factor at 0.9. The selection of equipment promotes energy savings and the operating recommendations reduce the maximum power demand on the utility system. The Energy Management Plan addresses the following:

> "RTA's vision of "Safe and Smooth Transport for All" led to the development of an integrated multi-modal public-transit system, which includes rail, marine and bus transit systems."

1. **Design for Energy Efficiency**
   In developing an energy-efficient design, the major sources of energy demand have been identified in order to support the consistent application of efficiency techniques and technologies.

2. **Energy Surveillance**
   A SCADA system is being used to monitor energy consumption using computer controls. The information is monitored on a real-time basis.

3. **Power Consumption and Maximum Power Demands**
   Power Consumption and Maximum Power Demands calculation of facility power (non-traction), rail system (Traction) power and total power are addressed together through Load Analysis and Voltage Drop Calculation, which provides the basis for the Power Distribution System (PDS) design.

Additionally, by using a water-cooled air-conditioning system supplied by a district cooling plant, instead of an air-cooled system, the total connected electrical load for the air conditioning has been reduced by more than 14MW. Moreover, total electrical consumption has been reduced by almost 29 million kWh per year. ■

ABOUT ABDULLA YOUSEF AL ALI



He is the CEO of the Rail Agency at the Roads and Transport Authority in Dubai. Mr. Al Ali has headed various departments in RTA, including the Road Maintenance Department and the Public Transport Department.



INTERVIEW

INTERVIEW:

HE MOHAMMED ABDULLAH AL JARMAN

General Manager of Emirates Transport (ET), Chairman of the Board of Directors of Emirates Transport Technology Solutions (ETTS)

How does the transport sector support UAE Vision 2021?

مواصلات الإمارات
Emirates Transport

What are the aims and objectives of Emirates Transport (ET) in supporting and developing a green economy in the UAE as outlined in the National Agenda?

HE Mohammed Abdullah Al Jarman: As a federal corporation, we have certain obligations and responsibilities towards the government, and society in general. This commitment is reflected in our strategic business plans and trends, which are drawn up to fall in line with the set objectives of the UAE government.

Therefore, the continued business growth and financial success of ET has to be managed and propelled within the overall aim of realizing UAE Vision 2021 and the Green Economy for Sustainable Development initiative launched by HH Sheikh Mohammed bin Rashid Al Maktoum.

The corporation's own CSR policies also demonstrate a firm commitment towards sustainable business practices, stemming from an inherent belief that it is up to major business players to take the lead in meeting the challenges facing both our immediate environment, and planet Earth in general.

Can you highlight key partnerships forged by ET to realise these goals (MoU with Etihad Rail etc.)?

> One of the most significant partnerships was established with the Ministry of Environment & Water

HE Mohammed Abdullah Al Jarman: One of the most significant partnerships was established with the Ministry of Environment & Water, which facilitated the exchange of expertise and best practices, as well as a collaborative effort to raise environmental awareness among students and ET staff.

The cooperation with the MoEW led to another significant partnership, this time with Dubai Carbon, which led to the vital step of measuring ET's baseline carbon footprint.

A shared component between the two mutual partnerships centres on increasing general awareness of environmental issues in society. This, in fact, is a common theme instilled in most MoUs signed with various public and private entities, a reflection of ET's commitment to its responsibilities towards society.

> The CNG Vehicle Conversion Centre (...) offers fleet operators from both the public and private entities with the opportunity to use a safe and green fuel alternative to petrol

What can ET do in terms of quality assurance and regulation?

HE Mohammed Abdullah Al Jarman: Quality management plays a very important role in what we try to achieve here at Emirates Transport. This is why we make a point, as a corporation, to encourage all our organisational units and business centres to adopt international best practices as part of their activities.

We also have thorough reviews and follow-up procedures that ensure the close monitoring and implementation of quality assurance standards.

Of course, the greater the business scope and size of an organisation, the greater this challenge becomes. This is why we place great emphasis on the continued training and education of employees as the best way of achieving higher standards.

A shared component between the two mutual partnerships centres on increasing general awareness of environmental issues in society. This, in fact, is a common theme instilled in most MoUs signed with various public and private entities, a reflection of ET's commitment to its responsibilities towards society.

> The use of the dual-trip system to transport male and female students to schools (...) received the "Grow with Public Transport" award (...) during The International Association of Public Transport (UITP) conference

> The waterless car cleaning service (...) greatly reduces the waste of water

Can you highlight examples of where ET has supported sustainable transportation in the UAE?

HE Mohammed Abdullah Al Jarman: We have introduced a number of award-winning services that we are proud of. The largest of these is perhaps the CNG Vehicle Conversion Centre, which offers fleet operators from both the public and private entities with the opportunity to use a safe and green fuel alternative to petrol, all whilst making medium and long-term savings on fleet operation costs.

We also launched the Tyre Retreading Unit, located in Warsan, Dubai, which recycles thousands of used tyres, using a process that can have enormously positive environmental implications. Using retreaded tyres can also have significant financial benefits for fleet operators.

Another service we recently launched was the waterless car cleaning service, which greatly reduces the waste of water and could, if used widely, have a significant effect on the preservation of such a vital resource and, subsequently, the energy required to produce it.

Another major contribution to sustainable transport is through better route planning for our school bus fleet.

A major innovative practice in this field is the use of the dual-trip system to transport male and female students to schools, which allows the use of the same bus to transport both male and female students in the same school district, but in two separate trips.

The system, which requires a high degree of organization and coordination and takes advantage of the hour difference in school start time for male and female students, offers considerable economic and environmental benefits.

The system received the "Grow with Public Transport" award for the MENA Region during The International Association of Public Transport (UITP) conference held in Geneva, Switzerland last year.

A number of other energy saving practices have also been applied directly to the transport services of ET, such as the introduction of Euro II and Euro III buses to the fleet and the CNG conversion of some ET vehicles.

It is our policy to study all available and economically viable options relating to green transport. We are, however, constrained by issues of market availability and technology development at this time, such as the case with electric powered buses.

ET has secured multiple Integrated Management Systems (IMS) certifications, including the ISO 14001 for the environment. What encouraged ET to pursue these? How does this fit in with ET's long-term strategy for sustainable transport services?

HE Mohammed Abdullah Al Jarman: As previously mentioned, ET is committed to achieving the highest standards across all its operations, and this means implementing internationally recognised practices such as those promoted and required by the International Organization for Standardization (ISO).

The ISO 14001 falls within this category and we used it to implement a number of management and operational practices that helped us to achieve our long term objective of becoming a more sustainable transport provider. ■



ENERGY EFFICIENT PUBLIC TRANSPORT



ARTICLE

By Dr. Yousif Al Ali

The Public Transport Agency (PTA) is responsible for realising the vision of the Road and Transport Authority (RTA): Safe and Smooth Transport for All, and executing the RTA's mission to develop integrated and sustainable transportation systems and provide distinguished services to all stakeholders. The public transport system in Dubai is one of the most developed in the Middle East. It can be benchmarked globally for its quality, comfort, fuel efficiency, and environmental sustainability.

PTA operates a wide variety of buses, including standard, double-decker, articulated and luxury, which cover Dubai and its neighbouring Emirates.

> RTA's current bus fleet has achieved an 11 per cent increase in efficiency (diesel consumption per km) compared to 2009, along with a 2.3 per cent increase in the number of passengers trips.

Advantages of the PTA fleet:

- Adoption of Euro 4/5 engines which reduce environmental pollution
- Use of Ad-blue to reduce the risk of polluting gases
- Use of biodiesel fuel in public buses and marine transport
- Use of modern technology such as automated shut-off engine when the bus stops
- Use of large-capacity vehicles such as double-decker and articulated buses
- Use of electric engines for the new abra fleet
- Continuous review of bus and marine transport routes to enhance services and increase stakeholder satisfaction
- Use of diesel with a very low sulphur content (10 parts per million), the first of its kind in the Middle East

Traditional Electric Abra

In an effort to preserve the UAE's heritage, RTA embarked on a plan of developing a traditional electric abra in 2006, which would be aesthetically similar to the traditional abra but operate using modern technology. In 2010 the first electric abra was produced, using very light material and a small carbon-neutral electric engine.

Following the successful trial run, 12 more abras have been built and launched and six more are currently under construction.



Traditional electric abra

Green Bus

The Public Transport Agency launched the first model of Dubai's green bus in late 2012, with the following eco-friendly features:

1. Solar cells used in the interior lighting of the bus
2. Energy-saving light technology (LED lights)
3. Seats made from recycled cloth
4. Re-treaded tyres that meet international standards
5. Insulated flooring made from recycled materials
6. Biodiesel fuel

Biofuel produces less emissions than normal diesel, resulting in the reduction of the Emirate's carbon footprint and improved air quality. The launch of the Green Bus pilot project has resulted in a 33 per cent reduction of carbon emissions per litre of fuel compared with regular diesel.

In addition to these initiatives, the PTA protects the environment in all its activities by recycling waste, including oils, metal waste (scrap),batteries, tyres, paper and cardboard as well as the water used for washing the bus fleet.



Green Bus use Biodiesel

Diesel Consumption

RTA's current bus fleet has achieved an 11 per cent increase in efficiency (diesel consumption per km) compared to 2009, along with a 2.3 per cent increase in the number of passengers trips. This has resulted in a significant decrease in carbon emissions, improving air quality and contributing towards a cleaner environment for Dubai.

The diagram below is a summary of the continuous improvement in the efficiency of diesel consumption in public-transport vehicles between 2009 and 2013. It demonstrates that although there has been a substantial increase in the demand for public transport, there is greater efficiency in terms of diesel consumption, resulting in a reduction of emissions and carbon footprint per capita.

Renewable Energy Use

PTA has conducted research to support the replacement of traditional energy sources with renewable energy in its facilities and buildings. In 2014, PTA began conducting a series of experiments in renewable energy applications to contribute to environmental sustainability and encourage the use of public transport. Some of these studies are:

1. Use of electric buses
2. Green bus depots in Al Khawaneej Bus Depot which meet global environmental specifications
3. Establishment of sewage treatment and use of water in irrigation
4. Use of solar-energy applications at bus shelters
5. Expansion in the use of biodiesel in buses and marine vehicles

Environmental sustainability can only be achieved if everyone works together. PTA encourages the residents and citizens of Dubai to opt for public transport in place of private cars as one simple method of contributing to a green city. Meanwhile, RTA wishes to send a message to all residents: Let us drive you to your destination safely. ■

> RTA wishes to send a message to all residents: Let us drive you to your destination safely.

ABOUT DR. YOUSIF AL ALI



He is the CEO of the Public Transport Agency in the RTA. He has headed various departments at the RTA and was the CEO of Dubai Taxi Corporation from 2011-2013.

KEY TECHNICAL CHALLENGES TO ELECTRIC VEHICLE ADOPTION IN THE UAE

CASE STUDY UAE

By Dr. Amro M. Farid

In recent years, electric vehicles (EVs) have gained much attention as a potential enabling technology to help achieve CO2 emissions-reduction targets. Indeed, EVs can have a well-to-wheel efficiency double that of conventional internal-combustion engine vehicles. Despite this advantage, the true success of EVs depends on their successful integration within the infrastructure systems that support them. The Masdar Institute Laboratory for Intelligent Integrated Networks of Engineering Systems has conducted a full-scale technical feasibility study – the first of its kind – for electric-vehicle penetration in Abu Dhabi. It considered multiple EV-penetration rates and charging-infrastructure configurations in a "microscopic" traffic simulation, in which the speed and location of each road vehicle could be observed. The results show five key technical challenges to support EV adoption across the region.

> "EVs can have a well-to-wheel efficiency double that of conventional internal combustion engine vehicles"

> "the true success of EVs depends on their successful integration with the infrastructure systems that support them."



Matching the EV to the Use Case

Typical electric vehicles have a range of approximately 150kms and require between half an hour to several hours to charge. Abu Dhabi is a relatively geographically spread-out city with a young public transportation system. Therefore, the most likely private Abu Dhabi EV user is one primarily interested in downtown driving. Another likely EV private-use case is as a second car, used primarily for running family errands. Yet, the real potential for EV adoption in Abu Dhabi is within public and commercial-use cases. Electric buses and trams move along well-planned routes that can be matched to their range and charging times. Similarly, commercial fleets like courier services and taxis can be dispatched as appropriate. Our results show that this matching of the EV to the use case is an essential activity and requires robust quantitative-analysis methods such as microscopic traffic-vehicle simulation.

Building Charging Infrastructure for Maximum EV Availability

Much like conventional vehicles and gas stations, the adoption of electric vehicles requires thoughtful consideration of the size, type, and placement of charging stations. Of course, the charging infrastructure must meet the desired EV-use cases in order to ensure that the EVs availability and use are maximised. While much research is based on home-charging, other use-cases are likely to demand charging stations placed in key locations across the city. These locations may include well-known landmarks, hotels, malls and parks. Each charging station can handle a given capacity of EVs, and the charging rate can vary from 10-50kW per EV. On the upper end of this range, fast chargers have been reported to bring charging times down to as little as 30 minutes. Our results show that the three aspects of charging infrastructure – charging station placement, size and rate – can improve the availability and penetration of EVs to a significant degree.

Making Integrated Transportation-Energy Planning Decisions

The results of the Abu Dhabi EV feasibility study suggest the need for integrated transportation-energy planning decisions. In addition to the cost of procuring the EVs themselves, it is necessary to carefully consider the cost of the associated charging infrastructure and the consequent power-grid upgrades. This is a complex techno-economic decision which requires input from multiple government agencies. The cost of power-grid upgrades can be shifted away from a power-system operator by keeping charging stations relatively small with slow charging rates. In contrast, the costs of a charging-system operator can be shifted to the power-grid operator with relatively large and fast charging stations. All the while, the charging infrastructure cannot lose sight of the EV-use cases for which it was originally intended. There are "sweet spots" in the development of charging infrastructure that can help meet the common interest. However, the optimisation frameworks for such integrated transportation-energy planning do not yet exist, and are an important area for further research and development.

Upgrading the Power Grid for Electrified Transportation

Electric vehicles are as much a component of the electric grid as they are of the transportation system. Their need for charging requires a power grid fit for purpose. Here, the concern is if multiple co-located EVs charge simultaneously, the required power can exceed the static limits of distribution-system transformers and lines. Our results show that this effect is exacerbated by the EV-penetration level but can be managed through careful design of the charging infrastructure. EV transportation behaviour also imposes a variable power load on the grid, which, if left unmitigated, acts much like renewable-energy integration. Power-grid operators would naturally have to work actively to mitigate this variability to keep the power grid in balance. ■

ABOUT DR. AMRO M. FARID



He is assistant professor of engineering systems and management and leads the Laboratory for Intelligent Integrated Networks of Engineering Systems at Masdar Institute, Abu Dhabi, United Arab Emirates.

ELECTRIC CAR CHARGING STATIONS

Around the world, more and more electric vehicles are coming onto the roads and highways, delivering carbon-free transport. With new battery technologies now available and more choices of vehicles now available, electric vehicles are already making their way on to Dubai's roads. DEWA supports the introduction of electric vehicles, as they decrease air pollution and protect the environment against the impact caused by motor-vehicle emissions.



These vehicles, and others that will follow, require a reliable infrastructure to manage their energy requirements, which is why DEWA is rolling out one of three key initiatives to provide this based on the Smart City initiative of HH Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, to transform Dubai into the smartest city in the world.

This project will involve a range of stakeholders to ensure its success. DEWA will work with the manufacturers of electric cars, as well as the Roads and Transport Authority (RTA), and Dubai Municipality to coordinate charging locations. DEWA will also work with a range of organisations regarding the siting and construction of car-charging stations in petrol stations, hotels and tourism centres, public and private clubs, car parks, airports and other locations.

Location is important when considering what types of charging station will be installed. Three different vehicle-charging stations will be installed based on the location and requirements. Slow chargers, which can charge vehicles over 6—12 hours, are ideally suited in homes, offices and hotels. Medium chargers that can fully-charge vehicles within 2—8 hours, and can be installed in shopping malls, offices and hotels. Fast chargers can charge vehicles within 20—45 minutes and will be installed at petrol stations and other locations that require fast-charging.

DEWA will begin installing 100 of these charging stations in shopping malls, airports, commercial buildings, residential complexes and petrol stations across Dubai in the second quarter of 2014. The work is expected to be completed within a year of the start of the project. This is a multi-stakeholder operation, and will be coordinated with Dubai Municipality, customers' representatives and other relevant parties. A second phase of expansion will follow, with the third stage completing the infrastructure for Dubai. The timing of these two stages will be determined on the basis of the experience gained during the current phase. Throughout the project, the feasibility of solar-powered vehicle charging stations will also be assessed.

The rollout of vehicle charging stations will also support Dubai in hosting the forthcoming Expo 2020. DEWA is also committed to enhancing the infrastructure and public utilities according to the highest international standards to satisfy the needs of the UAE's citizens, residents and businesses. By doing this, we can help boost the national economy and maintain Dubai's leading position as a global hub for trade, finance, tourism and green economy. ■

2020 AND 2050 – SIGNIFICANT YEARS FOR THE AVIATION INDUSTRY

ARTICLE

By Linden Coppell



With mounting pressure on airlines worldwide for climate-change action, the industry has set ambitious carbon-reduction goals. The commitment to 1.5 per cent efficiency-improvement per year is on track, achieved mainly through fleet replacement, improved operational efficiency and airport and airspace improvements.

However, two additional goals are posing a real challenge. The first, carbon-neutral growth by 2020, commits us to stabilising net emissions by 2020, while the second requires airline emissions to be halved by 2050, compared to 2005.

Although 2050 seems a long time away, 2020 is fast looming. Whilst the industry is confident it will continue to make incremental improvements in fuel efficiency through investment and innovation, a step change is required to allow the future goals to be met and give the industry its license to grow.

At Etihad Airways, like many other airlines, we believe alternative fuels are a key part of the solution. With the substantial progress made in alternative-fuel development in just a few years, non-fossil based fuels have the potential to contribute significantly towards decarbonising the aviation industry.
The industry has a clear remit when it comes to alternative fuels; they need to meet the same specification as the fuel we use today, thus requiring no modification of our aircrafts. With this in mind, three alternative fuel-conversion pathways have now been approved for use by commercial aviation, including ones that use plant oils and plant sugars.

Sustainability is an important factor to bear in mind. Many airlines, including Etihad Airways, have made a firm commitment towards alternative fuels by signing up to the principles of the Sustainable Aviation Fuel Users Group (SAFUG). Together, SAFUG member airlines account for over 30 per cent of commercial aviation fuel demand and work collaboratively to ensure sustainable feedstock and supply chains. These principles cover areas such as lower carbon footprint, the preservation of fresh water and promoting positive socio-economic benefit to local communities.

Etihad Airways is financially supporting investigations and piloting of an alternative-fuel feedstock in Abu Dhabi. The Masdar Institute-led Integrated Seawater Energy and Agriculture System (ISEAS) grows saltwater-tolerant plants fed by the nutrients from fish and shrimp farming. With greater global demands on fresh water and 97 per cent of the world's water being saline, this unique system offers a potentially sustainable means of creating biomass for conversion into fuel, without the need for fresh water.

Etihad Airways is also the driving force behind BIOjet Abu Dhabi: Flightpath to Sustainability, a multi-stakeholder initiative involving Boeing, the Masdar Institute, TOTAL and Takreer, the refining arm of the Abu Dhabi National Oil Company. BIOjet Abu Dhabi was established in January 2014 to help further a future sustainable aviation-fuel in-dustry in Abu Dhabi. Its launch was accompanied by a demonstration flight using an alternative sustain¬able fuel made from plant material. Such initiatives have reinforced the commitment of Etihad Airways to make real progress, both independently and with partners, while positioning Etihad Airways as a proactive leader in important carbon-reduction initiatives within the global aviation industry. ■

> "The commitment to 1.5 per cent efficiency improvement per year is on track"

ABOUT LINDEN COPPELL



She is the Head of Sustainability at Etihad Airways, responsible for developing the overall strategy for environmental management for the airline

CNG: THE EMIRATES TRANSPORT EXPERIENCE

OFFERING THE OPTION FOR A MORE SUSTAINABLE FUEL SOLUTION

CASE STUDY UAE

By Amer Al Harmoudi

Matching the EV to the Use Case

One of the main strategic goals of Emirates Transport is to pursue transport-related projects that achieve both financial- and environmental-efficiency objectives. One such example is the Compressed Natural Gas (CNG) Vehicle Conversion Centre, a project set up in cooperation with Abu Dhabi National Oil Company (ADNOC). Given the recognised environmental benefits of CNG as an alternative fuel to gasoline, and a clear gap in the UAE market, a decision was made to offer this service to both institutions and individual clients.

The pilot project started in the summer of 2010 with the modification of only two cars, and was officially launched in September of the same year. Currently, the vehicle-conversion service is offered through two stations in Abu Dhabi and one station each located in Al Ain, Dubai and Sharjah.

By the end of phase two (2013), Emirates Transport successfully converted 2,600 vehicles to operate on CNG for a number of major clients, including Abu Dhabi Police, Gasco and CG TECH, as well as taxi transport companies such as National Taxi, Emirates, Arabia and Al Ghazal Taxi.

In addition to modifying vehicles to operate on a dual-fuel system, the CNG Vehicle Conversion Centre also provides maintenance services for CNG-modified vehicles, in addition to related support services, employing a workforce of qualified professionals meeting international standards of knowledge and training.

The long-term economic benefits of using CNG as an alternative fuel are well-documented. The initial modification costs, however, remain a factor which can deter some individuals and smaller companies. It comes as no surprise that the more established institutions and companies, with larger fleets of vehicles, constitute the principal client base for the centre.

In addition, the limited availability of CNG fuelling stations and a lack of awareness contribute to this distribution profile of CNG users. However, efforts by the corporation and other public and private entities are slowly, but surely, contributing towards making CNG a real, viable option for average-income car owners. A statistical study by ET shows that converting cars to operate on natural gas has important environmental benefits. The reduction of greenhouse gas emissions can be illustrated in the following table:

> “Emirates Transport successfully converted 2,600 vehicles to operate on CNG for a number of major clients”

Gas	Reduction of emissions
Carbon dioxide	20-25%
Carbon monoxide	50-80%
Nitrogen oxide	25-60%
Methane hydrocarbons	50-80%

These issues facing the industry are not exclusive to the UAE – they can be found around the world. It is only when the issue has escalated to a global point that the real value of CNG as a greener fuel option can be clearly measured.

Awareness of general environmental issues, and in particular of the value of using CNG, can play a vital role in driving the virtuous circle of increased demand, lower cost and improved viability. Therefore, investors such as Emirates Transport have a commercial duty, as well as a moral duty, to raise awareness amongst the community.

In recognition of its success and environmental values, the Emirates Transport CNG Vehicle Conversion project has received many regional and global awards. Some of these awards include: Emirates Energy Award, Dubai Award for Sustainable Transport, Green Middle East and B-Green Awards. ■

ABOUT AMER AL HARMOUDI



He is the Executive Director of Technical Services Division at Emirates Transport. He joined Emirates Transport in 2002, after graduating from the Higher Colleges of Technology, with a diploma in Electro mechanics. He oversees the auto services sector at ET, which includes the CNG Vehicle Conversation Centre.



LIGHTING THE FUTURE

THE SUSTAINABLE LIGHTING PROGRAMME IN DUBAI

> “The smart operative initiatives include the reduction of operating time at sun set and sun rise by 20 minutes”

ARTICLE

By Eng. Maitha Bin Adai

Pursuing overall operational efficiency, the RTA as been focusing on key operations: street lighting has been identified as one of the major energy consuming operations within the Roads and Transport Authority. In the short-term, it was decided to implement a smart street-lighting network that will benefit from available best practices and technologies. This will represent a cornerstone in Dubai's journey to becoming a 'Smart City', meeting the vision of the Dubai Government.

The Dubai Street Lighting Project comprises an array of smaller-sized sub-projects, each aiming to reduce the current consumption of energy. The projects include operational improvements and the adoption of new technologies to reach the overall objective of a reduction in both power consumption and the carbon footprint.

The smart operational initiatives include the reduction of operating times at sunset and sunrise by 20 minutes. Other initiatives include partial switch-off of street lighting in internal residential areas after 10pm and full closure of some street lights in public parking areas. These have yielded a total reduction in the carbon footprint by over 3,000 tonnes of CO_2 annually.

Technology adoption initiatives approved for implementation as of 2014 include a programme to implement LED lighting in the Dubai traffic light system at over 410 of the existing road intersections. The other major initiative aims to implement an LED street lighting pilot scheme in residential areas (Al Barsha 1 & 2). This involves the installation of over 1,700 new street lighting poles. The project will be monitored for one year to measure efficiency in energy consumption as well as durability and performance in Dubai's harsh weather. Once the pilot scheme concludes at the end of 2015, the results will be used to inform the future development of street lighting in Dubai and a decision will be taken as to whether to roll out the technology to all new and existing installations. The planned initiatives in 2014 will result in the reduction of approximately 200 tonnes of CO_2.

The Traffic and Roads Agency is working towards meeting Dubai's strategic goals for efficient street lighting, which includes the implementation of 100 per cent LED lighting by 2030. This can help achieve a reduction in the existing carbon footprint for TRA operations by approximately 27,000 tonnes of CO_2 per annum. ■

ABOUT ENG. MAITHA BIN ADAI



She is the Chief Executive Officer (CEO) for Traffic and Roads Agency. Previously, she served as Director of Roads Department and as Head of Traffic & Technology section in Dubai Municipality.

07
CLIMATE CHANGE

HIS EXCELLENCY
DR. RASHID AHMAD BIN FAHAD

MINISTER OF ENVIRONMENT AND WATER, UAE



The UAE (United Arab Emirates) devotes its efforts along with the international community to face climate change challenges and adapt to climate change impacts, which are universal issues by which all countries are affected and thus must do their part to tackle. The UAE signed the UNFCCC in 1995 and was one of the first countries to adopt the Doha amendment.

The UAE will be affected by the universal phenomenon of climate change, as the sea level rise threatens the coastal line where the country's population is concentrated. The water scarcity in the country is expected to pose a greater challenge in the coming years as temperatures are expected to rise and precipitation is anticipated to fall.

The Green Growth Strategy has been the UAE's path since 2012. This strategy highlights the main pillars to achieve a full transition to a green economy and society and the use of green technologies. It also tackles climate change issues by to developing policies and programmes to reduce carbon emissions from industrial and commercial establishments. These will allow the country to adapt to climate change impacts and implement mitigation measures.

The Gulf is one of the regions with high levels of uncertainty when it comes to predicting the impacts of climate change. Thus we need to have further studies and investigations on climate change. Our scientists are working to fill the data gaps that would ultimately aid in selecting appropriate measures for the region to help the world turn the tide in improving the climate.

UAE Government institutions, together with businesses and non-governmental organizations, are working to reduce the emissions on a voluntary basis and taking important steps to reduce climate change impact. The UAE aims to utilize clean energy, enhance energy efficiency, increase the renewable energy share and employ sustainable transportation.

In tandem, this will help us preserve and save our natural resources, save our ecosystems and ensure their resilience when facing climate change threats. All these are our obligations towards people today and future generations.



WHAT IT WILL TAKE

THE UAE IS TAKING ANTHROPOGENIC CLIMATE CHANGE SERIOUSLY AND IS WORKING ON A VARIETY OF SOLUTIONS

Climate change has grown in importance and is now a top-level political issue both in the UAE and internationally. Here in the UAE, we are working both at home and abroad to adapt to the effects of climate change and reduce greenhouse gas emissions.

MAIN REPORT

By Dr. Thani Al Zeyoudi

Climate Change Science and Effects

The effects of global climate change are becoming ever more evident, with rising average temperatures leading to a wide range of impacts on natural and human systems. The International Panel on Climate Change (IPCC) reports concluded with 95 per cent certainty that human activity is responsible for this change.

The main mechanism behind climate change is well understood: Global warming is being caused by an excess of heat-trapping greenhouse gases (GHGs) – first and foremost carbon dioxide (CO_2), methane and nitrous oxide. GHGs trap infrared radiation in the atmosphere and raise global temperatures. Human activity has added large quantities of GHGs to the atmosphere, resulting in significant temperature rises. The IPCC estimates that without serious efforts to reduce GHG emissions, global temperatures will rise by more than 2 degrees Celsius over the next century, and could rise by as much as 5 degrees Celsius. A temperature rise above 2 degrees Celsius will trigger irreversible damage to the climate.

How will climate change impact the UAE?

Neither the UAE, nor the Middle East in general, will be immune to the physical or economic impacts of climate change. Countries in the region will be some of the most severely affected by a changing climate. Hotter temperatures and a decline in precipitation, coupled with the already unsustainable depletion of groundwater resources, pose severe risks to an already largely arid region. Projected sea-level rises also threaten dwellings and infrastructure. Moreover, as a country that is heavily dependent on imports, the UAE would be greatly affected by the global impacts of climate change – in terms of food security, regional stability, labour mobility and general sustainable economic development. Many of these factors are already reasons for concern, causing political unrest or humanitarian crises in the region. Unabated climate change will only work to exacerbate their impacts.

> Neither the UAE, nor the Middle East in general, will be immune to the physical or economic impacts of climate change

Direct Impacts on the UAE

- **Sea-level rise and water quality** – Global sea levels are predicted to rise between 0.26 and 0.81 metres by the end of this century, and to continue to rise for centuries to come. For the UAE, where coastal zones are home to approximately 85 per cent of the population as well as many attractive real-estate developments and over 90 per cent of water and power infrastructure[1], even modest sea-level rise would greatly increase the risks to our nation's infrastructure. Rising seawater temperatures and increasing acidification will also have a direct detrimental effect on people's quality of life, putting the Arabian Gulf, a valued resource long part of our nation's history, in jeopardy.

- **Higher temperatures** – By the end of the 21st century, the Middle East is likely to face an increase of 2 to 5.5 degrees Celsius in surface temperature. Such increases from already high current temperature levels, will put stress on the UAE's power and water supply systems. Higher ambient temperatures will hamper energy generation by reducing the efficiency and capacity of gas turbines, and will reduce the cooling efficiency of thermal plants, while greatly increasing the need for cooling of buildings and industrial processes. Cooling is already the single biggest source of energy consumption in the UAE – stretching our capacity to keep up with demand as the economy and population grow. Furthermore, energy distribution and transmission systems and other industrial infrastructure will be more prone to failure or more expensive to protect and maintain as temperatures rise and extreme weather events become more frequent.

- **Impact on UAE biodiversity** – Increases in ocean temperatures and higher concentrations of CO_2 will also lead to the acidification of water, thus putting some of the UAE's most biologically productive systems, such as mangrove forests and sea-grass beds at increased risk of extinction. The UAE is also home to many important marine species which will be adversely affected. Bu Tinah nature reserve in Abu Dhabi, for example, is amongst the few remaining known sanctuaries for dugongs – and today is home to the second largest population in the world.

- **Stress on water resources** – This may have the most severe impact with the greatest potential for disruption to our wellbeing. Greater evaporation and even lower amounts of rainfall compared to today's minimal levels will put greater pressure on already scarce water resources in the UAE. Billions of dirhams are already being spent to enable us to meet growing water demand. The stress that unabated climate change will put on our water supply by mid-century, and the associated financial costs, are difficult to imagine – if not unthinkable.

FOOTNOTES

EAD Report entitled "Climate Change Impacts, Vulnerability & Adaptation"
http://www.ead.ae/wp-content/themes/ead/publications/AD_UAE_Env_Eng/Climate%20change%20impacts%20-%20Eng.pdf



Indirect Effects

Equally critical to the UAE is our vulnerability to the global impacts of climate change. A clear illustration of this is in the area of food security.

The UAE imports more than 90 per cent of its food. With continuing population growth, and an environment with scarce renewable-water and agricultural potential, the UAE's food imports are expected to grow from AED14 billion in 2011 to AED20 billion in 2015 and over AED40 billion in 2020[1]. This reliance represents a major challenge for the UAE.

The UAE's food consumption is currently met by imports from over 100 countries, with the greatest share of imports coming from India, Brazil, China, the United States and Australia. In an effort to improve food security, the UAE has been investing in agriculture projects abroad in countries such as Vietnam, Cambodia, Egypt, Pakistan, Romania, Sudan and the Americas.

Projected climate change will, however, impact precipitation and increase extreme weather events in many of these countries. Furthermore, climate change may also cause agricultural productivity to shift between countries and hence alter the critical trade partnerships that are required to ensure a continuous and secure food supply for the UAE.

FOOTNOTES

http://www.thenational.ae/uae/growing-population-will-force-uae-to-face-up-to-food-security
http://www.alpencapital.com/downloads/GCC%20Food%20Sector%201%20May%202013.pdf

Renewable Energy

The UAE was the first country in the region to set renewable-energy targets, and has steadily increased its renewable-energy investment portfolio. In 2013, the 100 MW Shams 1 solar plant, the largest renewable-energy project to date in the region, was commissioned, as well as the Sheikh Mohamed Al Maktoum Solar Park, which is currently the region's largest PV installation, and a new wave of solar developments across the UAE is well underway.

Our clean-energy activities are not just at home: The UAE is also a major investor in renewable-energy projects and companies in a number of countries, including the United Kingdom, Spain and the United States. We are also a major donor, committing over US$450 million of concessional finance for renewables in developing countries, supporting projects in Afghanistan, Mauritania, Seychelles, and Tonga

Energy Efficiency and Demand Management

Along with renewable energy, energy efficiency is recognised as the second pillar of sustainable-energy policy, and as such has become a major policy imperative within the UAE. The strategies and plans of Abu Dhabi, Dubai, and the Federal Green Growth Strategy, among other initiatives, are all evidence of this. Labelling for efficient appliances, cost-reflective electricity tariffs, stronger regulation banning wasteful technologies and wide-ranging awareness and education programmes, all result in more sustainable consumption of energy and water resources – and of course a decreasing carbon footprint.

Peaceful Nuclear Energy

The UAE's commitment to a more diverse energy portfolio is also demonstrated by the construction of four nuclear reactors in the Western Region. These nuclear power plants, with zero carbon emissions, will meet about 25 per cent of the UAE's energy demand with safe, clean and reliable electricity by 2020, significantly reducing the emissions intensity of the power sector even further.

Cleaner Fossil Fuels

We have long been engaged in improving the performance of our oil and gas sector with respect to carbon emissions. Gas flaring, still a common practice in the many of the region's oil and gas fields, has been reduced to zero or near zero in the UAE (by law, only emergency flaring is permitted in the Emirate of Abu Dhabi), and the Abu Dhabi National Oil Company (ADNOC) has been a regional pioneer in flare-gas reduction since the 1990s.

We are also investing in carbon capture and storage technologies, which we are assessing for their potential to enable even deeper carbon cuts in the future. ADNOC and Masdar are today developing the region's first commercial-scale carbon capture, storage and usage project, which is set to re-inject 800,000 tons of carbon annually from industrial manufacturing emissions.

In the power and water sector, where much of our domestic gas consumption occurs, we are also seeing a shift to more efficient use of gas, which, of course, also lowers emissions. The UAE's power sector is almost exclusively fuelled by natural gas – the cleanest fossil fuel – used in largely efficient, modern power plants. Older, less efficient plants are being phased out over time and many of the country's utilities are looking to improve operations to reduce fuel consumption, and with that, CO_2 emissions.

WHAT IS THE UAE DOING?

The UAE has taken numerous actions to mitigate its GHG emissions, and adapt to climate change. Over the last decades, we have emerged as a leader, both in the region and globally, in supporting practical actions to address climate change.

Our leadership in the area of climate change and sustainability is anchored in a profound appreciation for the natural world, and the natural resources on which we all depend. Our founding father, the late Sheikh Zayed Bin Sultan Al Nahyan, said:

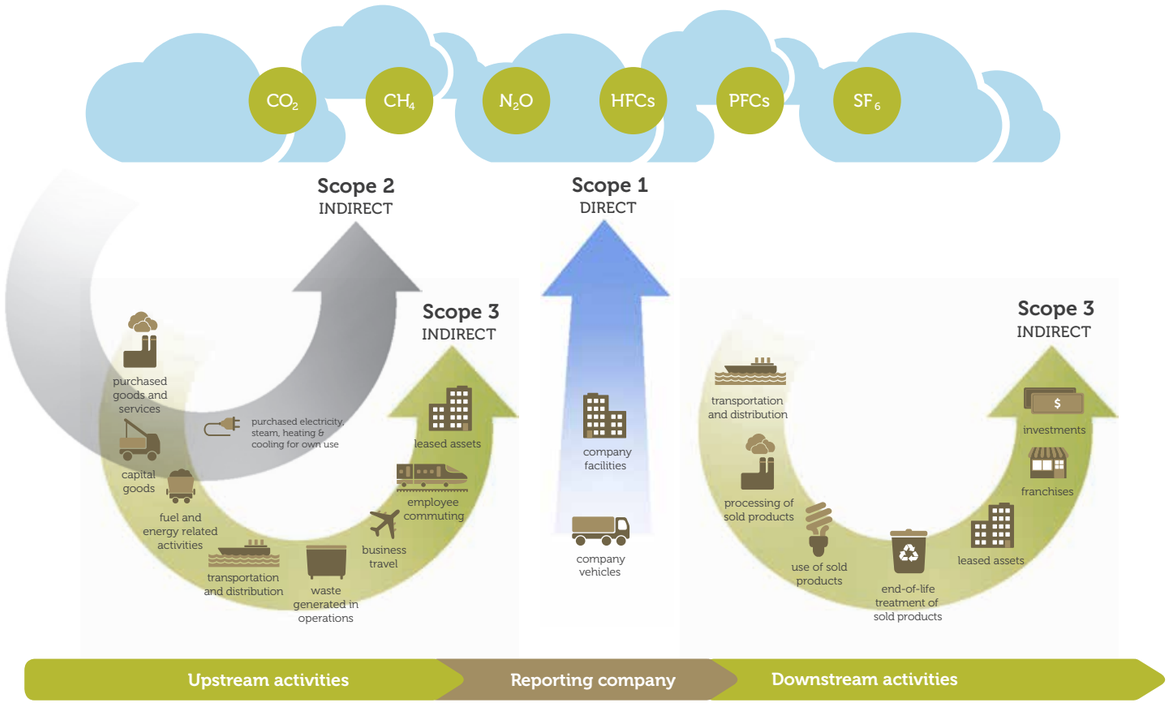
"We cherish our environment because it is an integral part of our country, our history and our heritage. On land and in the sea, our forefathers lived and survived in this environment. They were able to do so only because they recognised the need to conserve it, to take from it only what they needed to live, and to preserve it for succeeding generations.

With God's will, we shall continue to work to protect the environment and our wildlife, as did our forefathers before us. It is a duty, and, if we fail, our children, rightly, will reproach us for squandering on the essential part of their inheritance, and of our heritage."

Under his leadership, the UAE established the first conservation areas in the Middle East, and made respect for the natural world a core part of our values.

As the UAE's economy and influence grows, we have not lost sight of our founding father's vision, and have continued to invest heavily both at home and abroad, to preserve the environment and find solutions for climate change. In the last decade, underpinning these efforts has been a commitment to the diversification of our economy and energy mix, as well as creating positive solutions to reduce emissions while generating economic and social opportunities. Prime examples of this are our investments in clean energy – renewables, cleaner fossil fuels, peaceful nuclear energy and improvements in energy efficiency across the country. Beyond this we are also active in international engagement on climate change – along with institutional support through hosting IRENA and the MENA office of the Global Green Growth Institute (GGGI) in the UAE.

OVERVIEW OF GHG PROTOCOL SCOPES AND EMISSIONS ACROSS THE VALUE CHAIN



International Engagement on Climate Change

On the international stage, the UAE has been working as a progressive, bridge-building country within the United Nations Framework Convention on Climate Change (UNFCCC), in support of a legally binding global agreement to address climate change. In the lead up to the 21st Conference of the Parties, which will be held in December 2015 in Paris, the UAE will work constructively toward a deal that limits global average temperature rise to 2 degrees Celsius compared to pre-industrial levels, and towards negotiating an appropriate platform to communicate its voluntary domestic actions and initiatives.

> Over the last decades, we have emerged as a leader, both in the region and globally, in supporting practical actions to address climate change.

Outside of the formal UNFCCC process, the UAE has also been a strong and active supporter of the United Nations Secretary-General, Ban Ki-moon, and the 2014 Climate Summit. The Secretary-General has invited world leaders from government, finance, business and civil society to the Climate Summit this September in New York to galvanise and catalyse climate action. These leaders will meet to announce bold new actions and initiatives that will reduce emissions, strengthen climate resilience and mobilise political will for a meaningful international legal agreement in 2015. In May this year, Abu Dhabi was proud to host the Abu Dhabi Ascent, which was a critical milestone to the Climate Summit and was welcomed as a highly effective forum by world leaders. The Abu Dhabi Ascent was a further indication of our recognised leadership on climate-change solutions.

As the world's focus continues to turn to the global challenge of climate change, the UAE will remain steadfast in its commitment to help steer efforts for our country, the region and the world, towards a more secure and more attractive energy and climate future. ■

ABOUT DR. THANI AL ZEYOUDI



He is the Permanent Representative of the UAE to IRENA, and the Director of Energy and climate Change at the UAE Ministry of Foreign Affairs.



ARTICLE

By Eng. Aisha Mohammed Al Abdooli

The concept of green growth is a pathway which enhances the country's economic-growth ambitions, its social-development priorities and its environmental goals in an integrated way, whilst addressing wider environmental and social issues. In the UAE, it delivers a wide range of benefits and supports a range of Federal and Emirate-level visions and development plans.

This UAE Green Growth Strategy outlines the various options available to policy-makers and informs the wider public of opportunities for taking part in green-growth activities so as to support the transition to a greener and more prosperous UAE economy.

The UAE Ministry of Environment and Water, supported by the Global Green Growth Institute (GGGI), in collaboration with the Prime Minister's office and the Ministry of Foreign Affairs, is leading the development of an implementation plan for the strategy.

Building upon UAE Vision 2021, His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice-President and Prime Minister of UAE and Ruler of Dubai, launched a long-term national initiative in January 2012 – the UAE Green Growth National Strategy – to build a green economy under the banner of "A Green Economy for Sustainable Development".

With this initiative, the UAE seeks to become a global hub and a successful model for the new green economy, to enhance the country's competitiveness and sustainability and preserve the environment for future generations.

The initiative focuses on six major topics: green energy; green investment; green city; climate change; green life and green technologies. With the primary aim of developing a concrete set of policies, programmes and projects across all six fields, the implementation plan for the UAE Green Growth Strategy was developed through stakeholder engagement in a consultation process. The strategy outlines a pathway for the UAE's development, incorporating economic, environmental and social long-term goals.

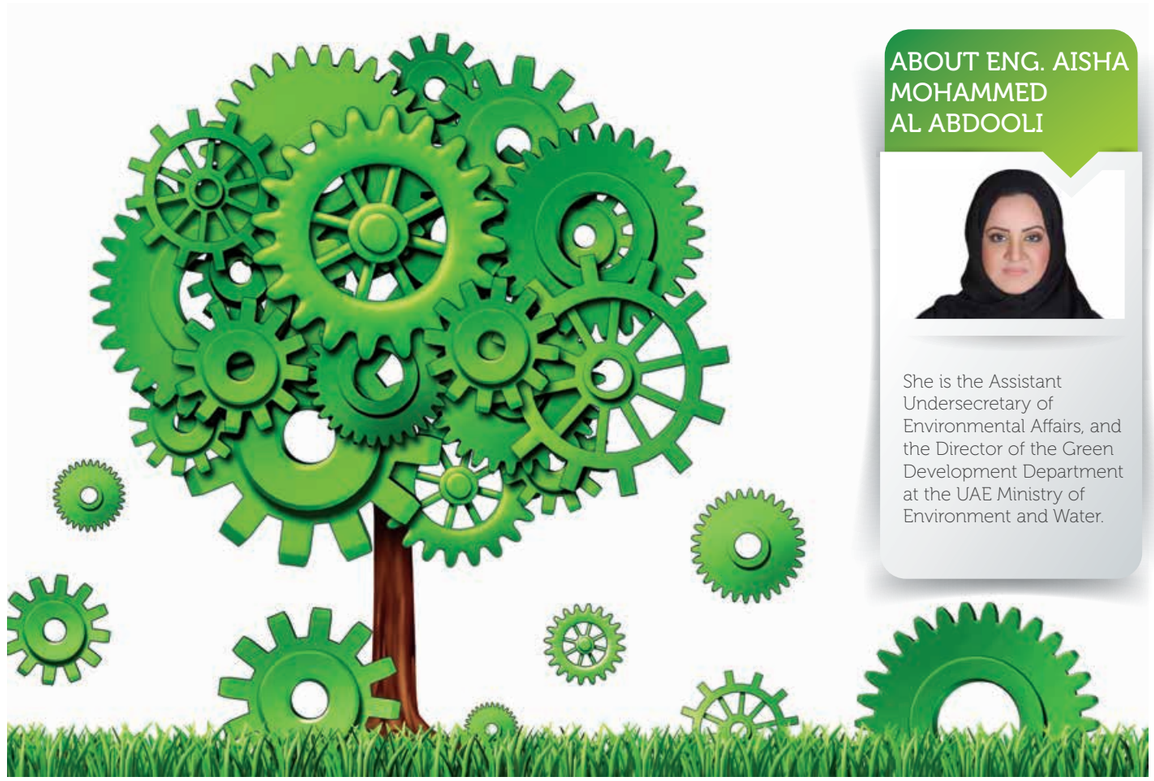
The development process of the implementation plan for the UAE Green Growth Strategy adhered to a number of principles to ensure alignment between stakeholders and robust decision-making:

- Build on existing policies and strategies: help deliver the goals of the UAE Vision 2021 and the Green Economy for Sustainable Development initiative and support Emirate-level visions and plans;
- Stakeholder driven: undertake extensive stakeholder engagement with public and private-sector collaboration across all sectors at the Emirate and Federal level;
- Evidence-based: build on previous UAE and international studies and relevant qualitative and quantitative research; and
- Cross-sector integrated: span all sectors of the UAE economy and enable cross-sectoral growth and development opportunities.

Alongside the extensive stakeholder consultation process, the strategy development also included four studies as the evidence-base to inform policy design:

- Analysis of the UAE's situation on green-growth challenges and existing policy initiatives
- Benchmarking of five countries (Brazil, Denmark, Indonesia, the Republic of Korea, and the UAE)
- Analysis of GHG abatement costs and key technology options
- Macroeconomic impact assessment of green-growth policies

These studies allowed for an integrated assessment of green-growth opportunities, specific technologies and potential policies.



ABOUT ENG. AISHA MOHAMMED AL ABDOOLI

She is the Assistant Undersecretary of Environmental Affairs, and the Director of the Green Development Department at the UAE Ministry of Environment and Water.

Green Growth Objectives for the UAE

To lay the foundations for the UAE's green growth actions, the following five strategic objectives have been identified in line with UAE Vision 2021, the Green Economy for Sustainable Development initiative and other long-term Emirate-level strategies and plans. These allow the Green Growth Strategy to support the achievement of existing goals, as well as diversify and establish new objectives.

The objectives set out what green growth means for the UAE and the direction towards which the country should strive by 2021 and 2030. The objectives are embedded in a balanced framework that supports the pursuit of economic, social and environmental sustainable development.

Enabling a Competitive Knowledge Economy

UAE Vision 2021 aims for a sustainable and diversified economy (Vision 3.2) as well as a knowledge-based and highly productive economy (3.3). These goals are also highlighted in the Green Economy for Sustainable Development initiative through green investment. Additional growth driven by a balanced set of new-growth engines, such as clean energy; energy-efficient, low-carbon technologies and production methods; demand-side measures and green public transport, will greatly help the diversification of the UAE economy which has traditionally been reliant on the oil and gas industry. This will also help increase national competitiveness, establish more small and medium-sized enterprises (SMEs) and create export opportunities from freed-up hydrocarbons and local clean-tech production.

Social Development & Quality of Life

Vision 2021 seeks to enable well-rounded lifestyles (4.3) and the highest standards of living as well as harnessing the full potential of national human capital through first-rate education (4.2). Nurturing local talent in knowledge-based green sectors will help create numerous jobs and developments which will improve the quality of life.

A Sustainable Environment & Valued Natural Resources

Vision 2021 seeks a sustainable environment and infrastructure for realising a well-preserved natural environment (4.4). Improved valuation of the nation's natural capital, development of climate-resilient real estate and the establishment of a competitive environmental goods and services (EGS) sector will help achieve this objective and reduce the nation's ecological footprint.

Clean Energy & Climate Action

The Green Economy for Sustainable Development initiative targets green energy and addresses climate change. Supporting the power sector's transition from a single fuel (natural gas) by increasing clean, low-carbon energy from renewable sources and nuclear-power energy will help reduce GHG emissions and tackle global climate change. The Vision 2021 goal of enhanced international standing (2.3) will be supported by pioneering climate action and energy diversification in an open, business-friendly economic environment.

Green Life & Sustainable Use of Resources

The Green Economy for Sustainable Development initiative aims to realise a "green life" among UAE citizens through building green cities and smart communities and using the country's resources in a sustainable manner. More efficient use of resources will bring direct benefits to the public through savings in water, electricity, and transport fuel as well as reducing waste, which in turn will make the wider economy more efficient, more competitive and more sustainable.

Green Growth Programs

Based on the above five strategic objectives, concrete programmes to realise green growth in the UAE have been developed. The gaps and opportunities in each of the key sectors identified were firstly categorised into the five objectives and further synthesised into major implementation programmes where the efforts of government, private sector and citizens can be focused. Twelve concrete green-growth programmes were identified, which are designed to achieve these strategic objectives. The programmes are interlinked, supporting the country in transforming its economic path in a holistic way. The programmes cover all of the key aspects for a green growth transition, including technology, human capital, the regulatory environment, green finance, international trade, local content and intellectual property, integrated national planning, and cooperation across the Emirates. Public awareness, standards and labelling are also seen as critical and are addressed within the programmes, as are improved data availability and performance reporting in general. ■

OVERCOMING OUR RESOURCE CHALLENGES

By HE Dr. Sultan Ahmed Al Jaber



A burgeoning global population and rapid economic growth are fueling demand for what is a finite supply of natural resources. The growing impacts of climate change also raise questions and create challenges in relation to resource use. It is in this context that the United Arab Emirates (UAE) is addressing its resource nexus, across energy, water and food. Based on the foresight and wisdom of the UAE's leadership, the country is finding opportunities in the challenge, and identifying ways to preserve and supplement the precious natural recourses on which the country depends.

With the global economy becoming ever more interconnected, so too has the UAE become more dependent on international trading partners to meet a considerable portion of our resource needs. As much as 90 per cent of the UAE's food is currently imported, and 40 per cent of our water needs are met using desalination. Our domestic energy demand, while a reflection of our strong economic growth, has been growing at an average annual rate of 10 per cent.

The UAE leadership recognises the complexities of the water, energy and food nexus and its potential impact on national security. In response, proactive policy measures have been taken, and astute investments have been made. In addressing our resource conundrum, our strategy has been to do so in a manner that increases our country's economic resilience, while simultaneously creating new human capital and investment opportunities.



The UAE has adopted a broad strategy of energy diversification to create economic opportunities and strengthen its energy security. By diversifying the primary energy sources used to generate power, we are able to free up a greater supply of hydrocarbons that would otherwise be consumed domestically, thereby maximising export opportunities and associated financial returns. To achieve this, the UAE is building liquid natural gas (LNG) terminals to create additional capacity and diversify its energy trade partners. Furthermore, the UAE's nuclear-energy programme is expected to meet nearly 25 per cent of the country's energy needs by 2020. We are also deploying renewable-energy projects. Shams 1, a concentrated solar plant, is a strategic investment that is bringing a 100-megawatt capacity on-stream and providing enough clean energy to meet the needs of 20,000 homes.

Perhaps more acute than energy is the water scarcity challenge that we face. Considering that only 1 per cent of the world's water is fresh and potable, His Highness General Sheikh Mohammed bin Zayed Al Nahyan, Crown Prince of Abu Dhabi and Deputy Supreme Commander of the UAE Armed Forces, summed it up best, stating: "Water is more important than oil." Our groundwater supplies are being depleted at an increasingly rapid pace, and are replenished at a rate of less than 4 per cent annually. With this in mind, the UAE has adopted a strategy that focuses on three key pillars: greater water conservation, innovation in research and development, and sound investment. We have been actively exploring different approaches towards securing sustainable, less costly supplies of water. We have also made significant investments in more efficient irrigation technologies to make our farms and greenhouses less water intensive. Both Abu Dhabi and Dubai have launched pilot projects and research programmes to explore how renewable energy can be used to power desalination plants.



Food security has been recognised as an imperative challenge faced by many nations around the world. The CGIAR Research Program on Climate Change, Agriculture, and Food Security estimates that 60 per cent more food will be needed globally by 2050. This comes on top of rising commodity prices and a more frequently volatile market for food staples amidst increasing global demand. The UAE has thus taken important steps to safeguard its access to food imports. This can be seen in our investments in farmlands around the world and our long record of multilateral cooperation and partnerships with key importers. We have ongoing agreements in Serbia, Namibia, Argentina and Brazil which provide access to existing markets, and ensure new market opportunities to sustain our growing population. We continue to keep an eye on long-term solutions through our efforts to support research and development around energy and water efficiency in order to bolster our food production and use less energy and water in the process. In addressing these challenges, the UAE has chosen a strategy that focuses on addressing its immediate national concerns, without compromising its global leadership as a key energy exporter and a steward for greater environmental awareness. We are pursuing a strategy of resilience that commits us to research and development, investment in technology, fostering greater international cooperation, and above all, resource conservation. It is through this diversified long-term strategy that the UAE is building the knowledge and human capital required to create sustainable solutions for the resource challenges we face. Ultimately, we trust that our comprehensive and innovative strategy will effectively help protect our natural resources, allowing our economy to continue to thrive, and our people to prosper. ■

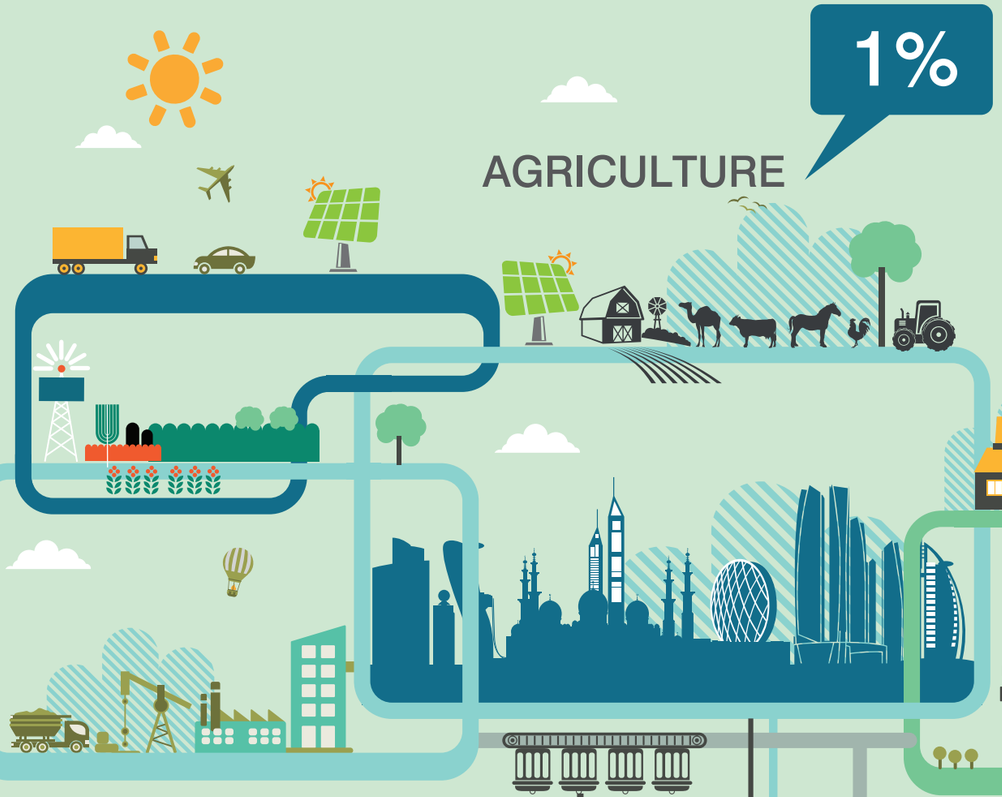
ABOUT HE DR. SULTAN AHMED AL JABER



HE Dr. Sultan Ahmed Al Jaber is the Chairman of Masdar, Abu Dhabi's multi-faceted renewable-energy company. He also serves as Minister of State in the UAE Cabinet and is Mubadala's Chief Executive Officer for Energy.

UAE GREENHOUSE GAS INVENTORY 2013

SEE THE CONTRIBUTION OF EACH SECTOR TO THE TOTAL GHG EMISSIONS OF THE UAE



19%

ROAD TRANSPORTATION

1%

AGRICULTURE

8%

INDUSTRIAL SECTOR: ALUMINIUM

15%

OIL & GAS

8%

MISCELLANEOUS[1]

6%

WASTE

35%

ELECTRICITY &WATER

8%

INDUSTRIAL SECTOR: CEMENT

* PROJECT NAME

Implement Energy Efficiency Measures to reduce Fuel Gas Consumption

Regenerative Burners for Melting Furnaces

Total Annual Emission Reduction Potential in tCO_2e

17,533

* PROJECT NAME

Flare Gas Reduction through Spiking Compressor at Shah

Total Annual Emission Reduction Potential in tCO_2e 109,142

* PROJECT NAME

UCC Rak Waste Heat Recovery

Total Annual Emission Reduction Potential in tCO_2e 59,361

DID YOU KNOW?

* Did you know that in 2014 the UAE had 14 emission reduction projects registered under the Clean Development Mechanism (CDM), the second most in the Arab World after Egypt. Meet some examples from the different sectors.

* PROJECT NAME

Ras Al Khaimah Landfill Gas to Energy Project

Landfill Flaring Project Dubai

Total Annual Emission Reduction Potential in tCO_2e

308,381

* PROJECT NAME

ADFEC 10MW Solar Power Plant

Abu Dhabi Solar Thermal Power Project (Shams 1)

Low Pressure Steam Generation by Recovering Waste Heat

10 MW Photovoltaic Plant in Dubai

DEWA Chiller Station

Sir Baniyas Wind farm

Nour 1 PV Plant

Total Annual Emission Reduction Potential in tCO_2e

433,744

[1] Includes other fuel use in industries; residential fuel use; domestic aviation; process emissions from iron and steel

THE UAE GHG INVENTORY

> Federal Energy Policy has already being announced by HE Suhail Al Mazrouei, the Minister of Energy

COMMENTARY

By Paola Ferreira



A ROADMAP FOR A FEDERAL ENERGY AND CLIMATE CHANGE POLICY

The message of this article is simple: the UAE now has a clear baseline for its greenhouse gas emissions (GHG). It is now able to develop a focused energy and climate change policy, targeting the main sources of these emissions: electricity generation, manufacturing industries and construction, and road transport.

> The case for a Climate Change Policy for the UAE is clear: in order to avoid future impacts of climate change at home, the country requires an effective global agreement to reduce GHG emissions

According to the 2012 GHG inventory:

- Emissions from the energy sector account for 78 per cent of the country's total emissions, of which fuel combustion activities make up 99 per cent;
- For fuel combustion emissions, the main sectors are energy industries with (54 per cent), transport (25 per cent) and manufacturing (20 per cent);
- Within the energy industries the principal source of emissions is electricity and heat production, accounting for 94 per cent of emissions, of which electricity generation represents 99 per cent.

The graph below illustrates these findings:



As this demonstrates, the main opportunities for emission reductions can be found in targeting fuel-combustion activities and within this sector, electricity generation should be the country's primary focus. It is worth noting that electricity and heat production includes emissions from co-generation from water desalination activities.

Manufacturing and construction emissions require further investigation, as noted in the UAE 2012 GHG Inventory. This is an important area for further research in order to inform current economic diversification policies across the different Emirates and the impact of high-emitting industries in the UAE's GHG profile.

With regard to the transport sector, the GHG 2012 inventory indicates that road transport accounts for 80 per cent of transport emissions. This calls for a focused policy on road transport that should be closely coordinated with the federal energy policy.

The efforts of several organisations in this respect should be noted, including the Road and Transport Authority (RTA) and the Abu Dhabi Department of Transport (DOT). Nevertheless, in order to maximise the emission-reduction benefits of transport policy, further coordination at the federal level would be welcome.

The focus areas for the country should be analysed and prioritised. Recent research has demonstrated that there are multiple win-win policies in the energy sector that the country could adopt to reduce its GHG emissions and provide net benefits for the UAE economy.

Why a roadmap for a federal energy and climate change policy? The case for a climate change policy for the UAE is clear – in order to avoid future impacts of climate change at home, the country requires an effective global agreement to reduce GHG emissions. The UAE can facilitate this by leading by example and implementing ambitious and credible domestic GHG reduction targets.

A climate change policy should address two main priorities. The first is adaptation[1], reducing the vulnerability of the country to the effects of global climate change. The second is mitigation[2], delivering growth on the basis of an energy-efficient and energy-independent economy. As illustrated above, most mitigation opportunities are to be found in the energy sector. There is therefore a strong case for a UAE climate change policy to be integrated into a federal energy policy in order to ensure achievable GHG mitigation targets.

The development of a federal energy policy has already been announced by HE Suhail Al Mazrouei, the Minister of Energy. This is a welcome step that will complement existing policy efforts in the Emirates, including the Climate Change Strategy for the Emirate of Abu Dhabi and the Dubai Integrated Energy Strategy. Likewise, close coordination is required with the Green Growth Strategy given its current focus on the energy sector. The commissioning by the Ministry of Energy of an updated 2013 GHG Inventory, to be prepared by Dubai Carbon, will help inform the country's future participation in the United Nations Convention on Climate Change and is an uplifting development. All of the elements for a successful roadmap are available for decision-makers, and the findings of UAE's GHG inventory should lead the way. ■

ABOUT PAOLA FERREIRA



She is Conservation & Climate Director of Emirates Wildlife Society in association with WWF (EWS-WWF).

FOOTNOTES

1 Climate change adaptation, as defined by the Intergovernmental panel on Climate Change (IPCC), refers to adjustment in natural or human systems in response to actual or expected climatic changes or their effects, which moderates damage or exploits beneficial opportunities.
2 Climate change mitigation refers to efforts to reduce or prevent emission of greenhouse gases.

WHAT ARE GHG EMISSION ESTIMATION METHODOLOGIES?

ARTICLE

By Meshayel Omran Lehsooni and Reshma Francy



The increasing concentration of Greenhouse Gases (GHG) in the atmosphere and its impact on climate change is a major concern for environmental policy makers. As the international community seeks to come to a consensus on the best way forward, government entities across the world are assertively formulating their standpoints and are participating in a discourse highlighting their contribution and exposure.

One of the ways of making an informed decision is by looking at Greenhouse Gas Inventories, which are similar in nature to individual or corporate level carbon footprints but follows methodologies that comply with international standards such as the United Nations Framework on Climate Change (UNFCCC).

The key governing body tasked with monitoring climate change is the Intergovernmental Panel on Climate Change (IPCC). The IPCC was established by the United Nations Environment Programme (UNEP) and the World Meteorological Organisation (WMO) in 1988 to provide a scientific review of the issues and impacts associated with climate change.

GHG Estimation Methodologies are developed by the IPCC to provide nations with appropriate guidance to estimate and report on GHG levels. The methodologies cover the main GHG contributing sectors: energy, waste, industrial processes, agriculture and land-use related activities.

The first set of guidelines were introduced in 1995 and revised in 1996. Entitled Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, it was later complemented with Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (GPG2000) and Good Practice Guidance for Land Use, Land-Use Change and Forestry (GPG-LULUCF). These guidance measures are adopted by countries when preparing inventories for their UNFCCC national communications. In 2006, the IPCC published the 2006 IPCC Guidelines for National Greenhouse Gas Inventories which provided updated emission factors for certain activities based on the latest available research.

Compiling the national GHG inventory involves a process that maps the consumption of resources. Activity data and appropriate emission factors are applied to specific activities thereby estimating GHG emissions. An approach to quantifying activities and identifying the associated emission factors are provided for in the IPCC guidelines. As an example, the energy sector consists of the energy industries sub-category. This sub-category includes CO_2 emissions from fuel combustion for the generation of electricity. The annual fuel combustion data is multiplied by the default fuel emission factors provided in the guidelines, which then helps in the compilation.

The IPCC also provides guidelines for industries including aluminium, iron, steel and cement, among others, which have GHG emissions arising from specific chemical processes (rather than energy use). These estimation approaches are based on stoichiometric calculations and emission factors specific to the technology used to get accurate estimates of emissions. In these cases, the IPCC provides the guidelines but encourages the inventory compilers to develop emission factors relevant to the region and technology.

Emissions can be coupled with other indicators, such as the Gross Domestic Product (GDP), to understand the carbon efficiency of the economy or divided by capita to help understand the carbon intensity of the population's way of life. These indicators can be used in specific sectors to identify the key areas requiring attention, and GHG reduction measures can then be targeted more effectively. Historical information in the GHG inventory can be used to identify trends in sectors such as transportation and electricity generation, and taking into account population growth forecasts, can be used in the formulation of GHG reduction policies. The IPCC guidelines also provide an outline for quality assurance measures, which can address problems of data gathering.

The ability for countries to compare their performance in specific sectors and creating opportunities for benchmarking is possible through the adoption of a uniform approach as defined by the international governing bodies.

The GHG inventory and related methodologies provide channels for communicating the efforts taken across the region to a global audience. The regular and consistent updating of the national GHG inventory is a good measure of ongoing climate change mitigation efforts among participating nations.

And what about corporate entities? The technical aspect of estimating GHG emissions remains the same when applied to entity level, but the approaches to data gathering and the reporting template are adjusted. The international methodology adopted by corporates is the GHG Protocol as published in The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (Corporate Standard), compiled by the World Resources Institute (WRI). The combination of the IPCC and GHG protocol is used by the ISO to create the ISO 14064 standard, providing a checklist for estimation and reporting.

As signatory to the Kyoto Protocol, the UAE has submitted three National Communications under the UNFCCC, led by the Ministry of Energy in 2006 (with 1994 data), 2010 (with 2000 data), and 2012 (with 2005 data) and maintains a monitoring, reporting and verification framework to compile more timely working level inventories on emirate and national level, with the latest being the 2013 inventory commissioned with Dubai Carbon. ■

ABOUT ENG. MESHAYEL OMRAN LEHSOONI



She is the head of climate change in the Ministry of Energy. Ms. Meshayel is responsible for the section of climate change activities, including the preparation of the fourth national communication report of the UAE, the GreenhouseGas Inventory of the UAE as well as the State of Energy Report 2015.

ABOUT RESHMA FRANCY



She is a technical support officer at Dubai Carbon Centre of Excellence and the driving force behind the UAE GHG Inventory 2013 following the IPCC Guidelines for the Ministry of Energy.

DID YOU KNOW?

The six gases classified as GHGs, as identified by the Kyoto Protocol, are carbon dioxide (CO_2), methane (CH4), nitrous oxide (N2O), perflourocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexaflouride (SF6),



INTERVIEW

INTERVIEW: ADNAN Z. AMIN

Director-General of the International Renewable Energy Agency (IRENA)

On bold investments in infrastructure and technologies made by the host country of IRENA

IRENA International Renewable Energy Agency

IRENA has made a considerable impact in discussions on the world's energy future. Will the institution have to keep expanding to match the expected growth of renewable energy?

Adnan Z. Amin: IRENA's membership agrees on the need for an effective and inclusive framework for international engagement on renewable energy, which is a critical element in the transition to a sustainable energy future in the context of the global challenges we face today. This vision unites countries of all sizes and economic types, including those that have prospered by exploiting conventional energy resources. The objective was never to create another large, unwieldy organisation. Instead, IRENA aims to be flexible, transparent, and responsive to the needs of its member states.

We don't aim to duplicate valuable work in the field done by other organisations. Rather, we seek synergies, to maximise the value that countries can attain from the expanding knowledge base on renewable energy. We are uniquely positioned to bridge the divide between developed and developing countries and between different regions with varied resources and energy needs. With a mandate to promote the sustainable use of all forms of renewable energy, IRENA brings together the widest possible range of actors, achieving unprecedented convening power for key discussions in the renewable energy sector.

70 countries took part in the founding conference for IRENA in 2009, and we have expanded steadily since our establishment in 2011, now encompassing around 170 countries, including over 130 members and nearly 40 participating countries in the process of becoming members. Uniquely among international institutions, IRENA has also benefitted from budget growth of about 20 per cent annually since we started. The success of the agency has much to do with a practical, needs-based and results-oriented approach. It should remain a lean and effective institution, rather than developing into a large bureaucracy.

How has being based in the UAE shaped IRENA's development?

Adnan Z. Amin: In the process of selecting the location for the agency's headquarters, the UAE presentation highlighted Abu Dhabi's strategic location, political stability, and good working environment, but also the country's global outlook and dedication to the long-term energy transition. To many at the time, it seemed surprising – perhaps paradoxical – that a leading oil exporter would host an institution dedicated to promoting renewables. But IRENA's successful establishment has confirmed the logic of this choice.

IRENA is the first global intergovernmental organisation to be headquartered in the Middle East. While the scope of our work is global, I believe our presence in the UAE has helped to inspire the GCC and MENA regions to take renewable energy seriously, recognise the feasibility and cost-effectiveness of the technologies available, and move forward with highly ambitious energy transition plans.

> "Over the last decades, we have emerged as a leader, both in the region and globally, in supporting practical actions to address climate change."

How serious is the commitment of the UAE and other GCC countries to renewable energy?

Adnan Z. Amin: The Arab region has the world's greatest technical potential for solar power. To develop that potential, countries throughout the region, led by the UAE, are marching forth with unflinching commitment. In the UAE, this commitment is coming in the shape of renewable-energy targets, especially by the emirates of Abu Dhabi and Dubai, and by making bold investments in infrastructure and technologies to meet such targets. Those investments are bearing fruit. In Dubai, the first phase of the Mohammed bin Rashid Al Maktoum Solar Park came online last year. And in Abu Dhabi, the 100-megawatt Shams 1 concentrated solar power plant vaulted the UAE into third position among world nations in total concentrated solar power capacity. Meanwhile, the UAE has also emerged as a key investor in major solar and wind projects in Africa and Europe.

Ground-breaking research is being done at the Masdar Institute in Abu Dhabi to develop storage and other capabilities, which are key to integrating variable renewable sources, in particular large-scale solar, into the energy mix.

The same commitment is equally clear in the UAE's successful bid to host IRENA, including the construction of purpose-built, sustainable headquarters, which will soon open in Masdar City.

Other countries, notably Qatar, have followed suit with substantial renewable energy projects. Saudi Arabia's plans call for solar development on the kind of scale that would transform the region's role in the energy sector. This is a region as rich in solar potential as in oil and gas. The transformation from fossil-based to mixed-energy economies, therefore, is ambitious but achievable.

> "IRENA is the first global intergovernmental organisation to be headquartered in the Middle East."

But is the economic logic of renewable energy sufficiently compelling, considering that new technologies are likely to open access to oil and gas reserves that are currently technically difficult and expensive to reach?

Adnan Z. Amin: Renewable energy is increasingly cost competitive on its own terms, and the costs of solar and wind technologies continue to fall rapidly, while hydro and geothermal are the cheapest forms where potential exists. For the last few years, the largest share of global power-capacity addition was from renewables. As such, countries around the world – including those in the Middle East and North Africa – can reap significant economic benefits from a transition to renewable energy. IRENA aims to show countries – including the private sector, as well as governments and utilities – the full range of options available if renewables are given a fair chance. This includes all forms of renewables; bioenergy; geothermal energy; hydropower; ocean; solar and wind energy.

Our global roadmap for the sector, REmap 2030, shows that countries can scale up the renewable share in the global-energy mix to 36 per cent or more by 2030, using the technologies available today. While the pace of this scale-up will vary, every country and region must do what it can. As a starting point, the greatest gains can be achieved by replacing coal with renewables.

To ensure investment in the sector, governments need to adopt enabling policies. At present, fossil fuels benefit from enormous subsidies, often at the expense of healthcare and education across the Middle East and North Africa. Most of the region generates its electricity by burning oil and gas – a burden for energy importers, and also lost revenue for energy exporters, which could otherwise sell the same oil at over US$100 per barrel or keep it for higher value-added industries, such as petrochemicals.

What are the main obstacles countries must overcome to scale up renewable energy?

Adnan Z. Amin: Each market and each technology faces its own set of challenges – and opportunities. Strong political will is needed to transform energy production and consumption. While state-owned energy companies are slow to change their ways, liberalisation of the energy sector can pave the way for investments in renewables. Naturally, governments must adopt the enabling policies, but the momentum for the transition must come from the private sector, including independent power producers (IPPs).

Another crucial gap to address lies in capacity building. This includes ensuring that administrators and technicians understand how to operate the power grid in a modern, flexible manner to make the best use of renewable sources, and that the skilled workforce is available for private-sector jobs for local manufacturing and services along the entire renewable-energy value chain.



Why is it important that we make a transition to renewable sources of energy?

Adnan Z. Amin: We are living in an era of fast-moving global change. In less than 40 years the global population is projected to grow from today's seven billion to an estimated nine billion. This growth will have immediate implications for energy demand, particularly in fast-developing and populous countries. These trends of economic and demographic change and energy consumption, as well as the need to address the irreversible trends of climate change, are sharpening global focus on the necessity for transition to a clean and secure energy paradigm.

The latest report by the Intergovernmental Panel on Climate Change reconfirms that averting catastrophic climate change is possible if we act now. But we must act decisively. Renewable energy, in combination with energy efficiency, provides the most affordable and technologically mature path to bring about the necessary change to meet that challenge.

What makes renewable energy different is that it not only reduces greenhouse gas emissions, but also creates jobs, grows economies, improves trade balances and reduces local air pollution, and does so at a lower cost than existing energy industries. An increasing number of countries are seeing this today, as more than half of power-sector capacity additions come from renewable energy. ■

> "Since our establishment in 2011, [IRENA is] now encompassing around 170 countries, including over 130 members"

CREATING AN ENVIRONMENT FOR EFFICIENCY

HOW THE ABU DHABI CLIMATE CHANGE STRATEGY IS BUILDING A RESOURCE-EFFICIENT ECONOMY

ARTICLE

By Dr. Mohamed Al Madfaei,
Eva Ramos and Maria Cordeiro

> "The Government of Abu Dhabi is committed to support the federal agenda to tackle climate change"



The Case for Action: The UAE is Highly Vulnerable to Climate Change

The Fifth Assessment Report on the causes and consequences of climate change released by the Intergovernmental Panel on Climate Change (IPCC, 2013) concluded, with higher confidence than ever before, that:



Scientists argue that to avoid a temperature increase of more than 2 °C above pre-industrial levels, CO_2 concentration in the atmosphere must be stabilised. An increase beyond 2 °C is likely to push the climate past the tipping point, beyond which some systems may not be able to adapt. This is particularly worrying for the UAE, since the country's terrestrial and marine ecosystems are already under stress due to high atmospheric temperatures and water scarcity, as well as from the temperature, acidity and salinity of the Arabian Gulf. Even small long-term variations in temperature, precipitation and the physical and chemical conditions of the Arabian Gulf could adversely affect terrestrial and marine ecosystems and water resources (EAD and SEI, 2009).

An increase beyond 2 °C is also likely to increase the frequency and severity of extreme weather events and the likelihood of rising sea levels as a consequence of melting ice sheets. This could affect water, agriculture, and critical coastal infrastructure in the decades ahead. These are aspects are of special concern for the UAE, since more than 85 per cent of the food consumed is imported and the food produced locally is highly dependent on the availability of scarce groundwater or, in its absence, of energy-intensive desalinated or recycled water. In addition, coastal zones are home to approximately 85 per cent of the population, over 90 per cent of the infrastructure, many sensitive ecosystems and important cultural heritage sites.

Scientists calculate that nearly half of all the CO_2 that can be emitted without raising temperatures above 2 °C has already been released. This means steps should be taken quickly to mitigate emissions to have a reasonable chance of avoiding trespassing over the limit. The mitigation pathways evaluated by the IPCC in its latest report estimate that keeping temperatures below the 2 °C target by 2100 will require large-scale changes to global and national energy systems over the coming decades. These scenarios are characterised by rapid improvements of energy efficiency, and a near quadrupling of the share of low-carbon energy supply from renewables, nuclear energy, and fossil energy with CO_2 capture and storage (IPCC, 2014).

Scientists also believe that some of the changes are irreversible in the short term. This means steps should also be taken to adapt to the impacts of climate change that are already occurring and those that are projected to occur in the decades ahead.

The UAE is an official party to the United Nations Framework Convention on Climate Change that sets the framework for intergovernmental efforts to tackle climate change. The UAE also ratified the Kyoto Protocol, the only legally binding agreement to date, to cut GHG emissions although, as a Non-Annex I Party to the Convention, it has no legal obligation to reduce or limit its emissions. Nevertheless, as expressed in UAE Vision 2021, the country is committed to adopting voluntary measures to mitigate and adapt to climate change.

The Abu Dhabi Climate Change Strategy: Clean Energy and Resource Efficiency

The Government of Abu Dhabi is committed to supporting the federal agenda to tackle climate change and fulfil the UAE's international commitments. With this purpose, it is developing a climate-change strategy for the period 2015-2019. The strategy is founded upon six key pillars and a set of imperatives and programmes that are consistent with the priorities set in Abu Dhabi Environment Vision 2030 and in the UAE Green Growth Strategy, pending approval. Upon these pillars, the Emirate of Abu Dhabi aims to build a knowledgeable, innovative, healthy, educated and aware society; a diversified, green, resilient and competitive economy; and a sustainable and valued environment that ensures the wellbeing of present and future generations.

Abu Dhabi has a relatively low level of GHG emissions – less than 0.5 per cent of global emissions. For this reason, the voluntary adoption of measures to control and limit domestic GHG emissions would have a negligible impact on solving the problem of global climate change. However, the Emirate has high per capita emissions – more than triple the OECD average (OECD, 2013). More than 70 per cent of GHG emissions are associated with energy production and consumption activities (EAD, 2012).

In Abu Dhabi, per capita consumption of water and electricity is now amongst the highest in the world and has grown steadily in the last few decades. ADWEA has met annual average demand increases of 7.3 per cent per year for electricity and 9.5 per cent for water in the period 1998-2012. According to ADWEC, Abu Dhabi's electricity demand is growing faster than China's in percentage terms, and is growing two to three times faster than economic activity. It is expected to continue to grow in the future (ADWEC, 2011). To place these figures in perspective, according to the last International Energy Outlook Report (IEA 2013), growth in electricity generation worldwide is projected to rise by 2.2 per cent per year on average from 2010 to 2040. The strongest growth is projected for non-OECD countries, which increase by an average of 3.1 per cent per year, while in the OECD nations, where infrastructures are more mature and population growth is declining, the projected growth in power generation averages 1.1 per cent per year over the same period.

Therefore, Abu Dhabi offers great potential to decouple GHG emissions from economic and population growth through greater resource efficiency, in particular energy and water efficiency.

Taking into consideration the strong water-energy nexus in the UAE, improving energy and water efficiency should go hand in hand. More than 70 per cent of the nation's overall water production and processing costs results from the energy required to desalinate, transport, store, forward and distribute water, demonstrating the pressing need for new approaches to water management to tackle climate change.

To address its growing energy needs, the Emirate is embarking on an ambitious program to increase its reliance on low-carbon energy (clean-fossil based technologies, renewable energies, and nuclear generation) for power and water generation. However, the ongoing diversification of the energy mix alone will not be enough to offset the increase in carbon emissions driven by population and economic growth.

To reduce energy intensity, the way energy is used also needs to change. Investments in energy efficiency are by far the most cost-effective way to decouple rising demand for energy from rising supply. The priority is to retrofit inefficient capital stock with energy-efficiency measures, and, whenever possible, to leapfrog by investing in much more efficient technologies and systems from the start (WWF, 2010), a path that is already being explored by the Energy Efficiency Committee (2013).

Abu Dhabi can also play an important role in the transition towards a low-carbon global economy by facilitating the research, development, diffusion, transfer and application of technologies that can meet the strategic needs for MENA countries (low-carbon cooling, water desalination and irrigation). The priority is to create an innovation ecosystem to generate and apply new clean technologies, a path that is already being explored by the Masdar Institute of Technology (2009) and the Takamul Program (2012). This would allow Abu Dhabi to pave the way for green growth not only domestically but also regionally. ■

FOOTNOTES

ADWEC (2011): Economic Development and the Growth in Electricity Demand. MEED Abu Dhabi Conference 2011 15th – 16th November 2011 http://www.adwec.ae/documents/ppt/meed_november_2011_final_for_adwec.pdf

EAD (2012): Greenhouse Gas Inventory for Abu Dhabi Emirate: Inventory results-Executive Summary. Environment Agency-Abu Dhabi. https://www.ead.ae/_data/global/book/ghg-brochureenglish.pdf

EAD & SEI (2009): Climate Change: Impacts, Vulnerability and Adaptation Coastal Zones in the UAE; Water Resources in Abu Dhabi; Dryland Ecosystems in Abu Dhabi. Environment Agency – Abu Dhabi and the Stockholm Environment Institute - US Center. https://www.ead.ae/_data/global/book/climate%20change%20book%20full%20english.pdf

EIA (2013): International Energy Outlook 2013. Washington: U.S. Energy Information Administration http://www.eia.gov/forecasts/ieo/pdf/0484(2013).pdf

IPCC (2014): Summary for Policymakers, In: Climate Change 2014, Mitigation of Climate Change. Contribution of WG III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change Geneva. Cambridge UP http://report.mitigation2014.org/spm/ipcc_wg3_ar5_summary-for-policymakers_approved.pdf

IPCC (2013): Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis. Contribution of WG I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge UP. http://www.climate2013.org/spm

OECD (2013): The OECD Environmental Outlook to 2050. Key Findings on Climate Change. Paris: Organization for Economic Cooperation and Development. http://www.oecd.org/env/cc/49082173.pdf

WWF (2010): Climate Solutions: WWF's Vision for 2050. Geneva: World Wide Fund. http://www.wwf.org.uk/filelibrary/pdf/climatesolutionreport.pdf

DID YOU KNOW?

http://tdc.gov.ae/tdc//weben/page_TakamulProgram.aspx

ABOUT DR. MOHAMED AL MADFAEI



He is the Executive Director of the Integrated Environment Policy and Planning Sector at the Environment Agency - Abu Dhabi.

ABOUT EVA RAMOS



She is the Director of Environmental Analysis and Economics at the Environment Agency - Abu Dhabi.

ABOUT MARIA CORDEIRO



She is the Section Manager for Environmental Analysis at the Environment Agency – Abu Dhabi.

ENERGY PLANNING, ANALYSIS AND POLICY MAKING AROUND GHG EMISSIONS

ARTICLE

By Clemens Plöchl
and Reshma Francy



THE DUBAI CARBON ABATEMENT STRATEGY 2014 IS A GLOBAL SHOWCASE FOR A MULTI-STAKEHOLDER LEGISLATIVE PROCESS

Climate change is already being observed through rising temperatures, melting glaciers, shifting rain patterns, increased storm intensity and rising sea levels. Greenhouse Gas (GHG) emissions from human activities – mainly fossil fuel use, deforestation and agriculture – are known to cause climate change. If GHG emissions are not reduced significantly below current levels within the next few decades, there will be further warming and sea-level rises for centuries to come, resulting in adverse impacts on human health, natural ecosystems, and the economy.

An example can be seen in the UAE, where up to 85 per cent of the population and 90 per cent of the infrastructure of coastal zones are at risk from climate change as pointed out by a study conducted in 2009 by the Stockholm Environment Institute.

Recent years have witnessed a fundamental change in the way governments approach energy-related environmental issues. Promoting sustainable development and combating climate change have become integral aspects of energy planning, analysis and policy making in many countries. Since the early 1990s, most industrialised nations and many developing countries have implemented climate change-related policies.

The UAE understands the challenges of climate change and sees the opportunities for green growth. As a result, is has developed ambitious national and emirate-level strategies over the past few years, including:

UAE Vision 2021:
The UAE aims to establish the country as the best living environment globally.

Dubai Integrated Energy Strategy 2030:
Sets the strategic direction of Dubai in securing sustainable supplies of energy and enhancing efficiency in water, power and fuel use.

EXPO 2020:
To become a carbon neutral mega-event with sustainability as one of its main themes.

Monitoring – Reporting and Verification Studies:
Provides a GHG inventory for the UAE including the necessary information to develop a comprehensive carbon abatement policy.

In addition, Dubai and the UAE are hosting or participating internationally in:

International Renewable Energy Agency (IRENA):
This is the intergovernmental organisation based in the UAE that supports countries in their transition to a sustainable energy future.

United Framework Convention on Climate Change (UNFCCC):
Provides a multilateral framework for international climate change policy.

To give an example from the emirate of Dubai, the Dubai Supreme Council of Energy (DSCE) in collaboration with Dubai Carbon Centre of Excellence (DCCE) launched an inclusive process in December 2013 to develop a holistic carbon abatement strategy. This process will help meet Dubai's specific development requirements whilst also being aligned with national and international carbon policies.

The policy-making approach follows internationally accepted standards such as the IPCC guidelines and adapts the UNDP methodology outlined in Key Steps in Preparing a Low-Emission Climate-Resilient Development Strategy to the specific situation of Dubai.

In the first phase DSCE and DCCE set up a committee structure where a:

- steering committee shall be supported by a
- technical committee in addition to a
- stakeholder consultation group

While the steering committee provides overall strategic and political guidance, the technical committee aggregates and proposes potential mitigation measures and activities and the stakeholder consultation group provides industry-specific competencies. DCCE acts as technical secretariat to the committees, delivering up-to-date analysis and decision support.

In the second phase, the Dubai GHG inventory (Dubai´s MRV studies) prepared by DCCE is broken down to the main economic GHG emitting sectors such as:

- Electricity and water
- Manufacturing
- Oil and gas
- Transportation
- Waste management

Main representatives of these sectors provide information about their activity forecasts and environmental strategies, which DCCE in turn translates into GHG emission projections and technical GHG mitigation activities. DCCE also intends to identify additional international best practice examples which could be implemented in Dubai. 2011 was selected as a base year for emission projections and 2030 as the final year. This time horizon is in line with national and international forecasts and policy frameworks.

The Dubai Carbon Abatement Strategy will combine the numerous recent GHG initiatives announced by Dubai´s stakeholders, while at the same time growing the economy under one comprehensive policy. The Dubai Demand Side Management Policy implemented by DSCE will be included, as well as Dubai Municipality's measures for reducing GHG from waste, the climate strategies of Dubai Aluminium and Emirates National Oil Company (being the main players in the manufacturing sector) and activities of the Road and Transport Agency.

In the third phase, the committees will agree on the final policy or targets, the time plan and the required policy instruments to incentivise the implementation of technical GHG reduction options. The specific situation in Dubai, where only a limited number of entities are responsible for the greatest volume of GHG emissions, may support a voluntary instrument in contrast to other regions of the world where many entities need to be subject to regulation.

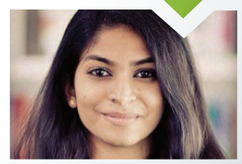
The Carbon Abatement Strategy could serve as a showcase for other regional entities. It will be integrated in the UAE´s submission to the UNFCCC for Independent Nationally Determined Contributions. This is anticipated by the first quarter of 2015 on the road to Paris, where the next international GHG treaty is scheduled to be finalised. ■

ABOUT CLEMENS PLÖCHL



He has around 17 years of experience in all aspects of inter-/national climate change and energy policy and finance. He is currently acting as head of operations at the Dubai Carbon Centre of Excellence.

ABOUT RESHMA FRANCY



She is a technical support officer at Dubai Carbon Centre of Excellence and the driving force behind the UAE GHG Inventory 2013 following the IPCC Guidelines for the Ministry of Energy.

EGA
الإمارات العالمية للألمنيوم
EMIRATES GLOBAL ALUMINIUM



FORGING A STRONGER FUTURE

Without sustainability, the whole world will eventually grind to a halt. That's why we take our responsibilities very seriously. We put safety as our number one priority and look after our precious resources by using advanced technology to preserve energy and reduce our carbon footprint, to take care of the planet, our people and the future.

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Global Excellence in Aluminium

DECARBONIZING THE UAE ECONOMY

THE CEO OF THE DUBAI CARBON CENTRE OF EXCELLENCE ON ENABLING MARKET MECHANISMS

COMMENTARY

By Ivano Iannelli

The recent 5th assessment report by the United Nations Intergovernmental Panel on Climate Change (IPCC) sets out the potentially irreversible impacts and tipping points facing humanity as a result of climate change. The resource consumption trends at global level make the need to find a binding agreement in Paris in 2015 all the more urgent.

But as political leaders struggle to find a policy consensus to tackle climate change, in some countries private industry is taking the lead. In the United States of America for example, companies such as Walmart already began planning for a carbon price in 2013. Numerous programmes, including the World Bank's "Pricing Carbon" initiative, aim to raise private sector awareness on the financial liability of climate change. While the Kyoto protocol has been successful in mobilizing private sector investment in climate mitigation, attention is now turning to a potential "Paris Protocol" which will carry forward the ambition and objectives of its predecessor.

Two approaches are under consideration as part of the international negotiations. A New Market Mechanism (NMM) will seek to take forward the work of the existing Clean Development Mechanism (CDM). The CDM has been a useful tool to mobilise private sector momentum towards investments in clean technologies and processes. Additionally, the Framework of Various Approaches (FVA), will act as an umbrella agreement to harmonize and connect carbon markets across the globe. The diversity of market mechanisms emerging at both national and regional level has allowed innovation while recognizing that a one-fits-all approach may not be possible.

When developing carbon abatement policies for business, one of the most important considerations is the nature of the economic and fiscal environment in which they operate. Many countries use non-market mechanisms, such as carbon tax regimes, to promote the uptake of environmentally friendly technologies. The UAE does not have such a system of corporate taxation, making it more difficult to pursue a fiscal approach.

However, the UAE is not simply standing by, waiting for an agreement to be reached. In typical Emirates fashion, it is taking a pro-active approach towards developing a long-term carbon market strategy. The preference is rather to focus on incentive-based mechanisms. The country aims to foster regional stewardship and promote best practices across different industries and stakeholders through a practice of operational efficiency.The pursuit of excellence, deeply embedded within UAE Government culture, will help the country rise to the challenge of managing greenhouse gas emissions associated with economic growth, as well as tapping into the potential for the green economy.

The UAE has developed a sustainable vision and strategy for the 2021 Golden Jubilee (Vision 2021), as well as energy and resource-focused strategies to 2030 at Emirate level. The commitments made in these strategies could provide the foundations for the creation of a carbon market in the MENA region. Many countries in the region share similar challenges and profiles, and successful approaches could be easily replicated. Rather than developing a complex system of policies and regulations, market mechanisms could be used to engage the private sector in regional green growth. When the world meets in Lima in early December to discuss the text to be approved next year in Paris, the role of the private sector, and more specifically the opportunity for mobilizing the entrepreneurial spirit of the UAE and the wider region, should be supported as a key opportunity to demonstrate green excellence. ■



ABOUT IVANO IANNELLI



He is the CEO of Dubai Carbon Centre of Excellence. As a member of the Senior Management team of the United Nations and the Italian Ministry of Foreign Affairs, he has managed important projects under highly challenging circumstances.

INTRODUCING THE LOCAL, NATIONAL, REGIONAL CLIMATE CHANGE PROGRAMME

FACT BOX

By Ahmed Baharoon

Driven by a growing awareness that the UAE, as well as other GCC countries, may be particularly vulnerable to climate change, the Local, National, Regional Climate Change Programme (LNRCCP) was developed to provide much-needed baseline climate change-related data and analysis in the Arabian Gulf region. Scientific information plays a critical role in policymaking and planning at local, national and regional levels.

Led by the Abu Dhabi Global Environment Data Initiative (AGEDI), and supported by the Environment Agency - Abu Dhabi (EAD), the programme is the first of its kind in the Arabian Gulf. The four-year LNRCCP is a strategic initiative that can help regional leaders, innovators and decision-makers better understand critical risks and the range of options available to them across five key thematic areas:

LNR CLIMATE CHANGE ASSESSMENT PROJECT 2013 - 2016 - 5 THEMATIC AREAS

12 Sub-projects - Assess the Impacts, Vulnerability & Adaptation to Climate Change in the Arabian Peninsula

SOCIOECONOMIC SYSTEMS	2014-2015	01	Public Health Benefits of GHG Mitigation	Food Security / Desalinated Water Supply
REGIONAL CLIMATE CHANGE	2013-2014	02	Atmospheric Modeling	Arabian Gulf Modeling
ENVIRONMENT	2015	03	Terrestrial Ecosystems	Marine Ecosystems
COASTAL ZONES	2015-2016	04	Coastal Vulnerability Index	Sea Level Rise
WATER RESOURCES	2015-2016	05	Al Ain Water Resources	Water Resources Management / Transboundary Groundwater

3 SPATIAL REGIONS

- Local
- National
- Regional



Commencing in 2013 and running through to 2016, the project is broken into 12 integrated sub-projects. These sub-projects represent a systematic analysis of climate-change vulnerability and adaptation issues in the region. One sub-project, for example, focuses on an assessment of the vulnerability of current practices in water desalination and electricity supply in the Arabian Gulf. Another relates to the energy sector, explaining how the planned measures to reduce greenhouse gas emissions in Abu Dhabi can lead to public health benefits.

Ultimately, the project aims to develop and provide access to usable, high-quality environmental data within the context of local/regional partnerships and effective stakeholder engagement. As such, it offers an important basis upon which to develop high-level, coordinated decision-making about climate-change adaptation. ■

هيئة البيئة - أبوظبي
Environment Agency - ABU DHABI

AGEDI
مبادرة أبوظبي العالمية للبيانات البيئية
Abu Dhabi Global Environmental Data Initiative

BLUE CARBON

> Blue Carbon ecosystems in Abu Dhabi likely provide services worth hundreds of millions of US dollars annually



ARTICLE

By Ahmed Baharoon

The Abu Dhabi Blue Carbon Programme aims to improve our understanding of carbon sequestration and the other ecosystem services that coastal blue-carbon ecosystems provide in the Abu Dhabi Emirate and the UAE. Facilitated by the Abu Dhabi Environmental Data Initiative (AGEDI), with the support of the Environment Agency - Abu Dhabi, the programme is supported by leading international coastal carbon scientists GRID-Arendal, UNEP, UNEP-WCMC, and Forest Trends.

Blue Carbon refers to the ability of coastal and marine vegetation to sequester and store carbon. Blue Carbon ecosystems typically include mangrove forests, salt marshes, and seagrass beds, which sequester atmospheric carbon and store it in both their biomass and sediments. When these ecosystems are destroyed, stored carbon can be released into the atmosphere as carbon dioxide (CO_2), contributing to climate change and ocean acidification.

Understanding Blue Carbon resources can therefore assist in determining the extent to which preserving these ecosystems can help mitigate this risk. Coastal habitats also provide myriad essential ecosystem services – they support fisheries, protect shorelines, provide opportunities for tourism and are important for cultural heritage and identity. Initial findings from the demonstration project conducted in 2013 found that overall, Blue Carbon ecosystems in Abu Dhabi are estimated to store over 41 million tonnes of carbon dioxide equivalent (t CO_2e) within the soil and biomass, more than the Emirate's annual emissions from oil and gas (26.4 million tonnes) or water and electricity (30.9 million tonnes) sectors. (AGEDI, 2014)

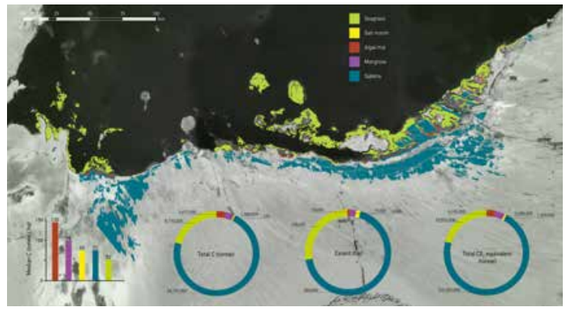
In addition, the findings across the range of ecosystems studied showed intertidal cyanobacterial mats (blue-green algal) as having the highest combined above and below ground carbon stocks per hectare.

ABOUT AHMED BAHAROON



He is the Executive Director of Environmental Science Information & Outreach Management and AGEDI Acting Director

07. CLIMATE CHANGE



These algal mats, unique to the Gulf states, are associated with areas of sheltered intertidal mud and are the present-day representation of the earliest-known forms of life, identified in rock records dating back 3.2 billion years. Overall Blue Carbon stocks are estimated to be highest in seagrass, due to the large size of the ecosystem. Coastal sabkha (salt flats), which are considered an associated ecosystem, also hold significant amounts of carbon, highlighting the importance of well-informed planning of sabkha conversion for development purposes.

The average total carbon stock in planted mangroves of different ages (79.92 tonnes/ha) was lower than that of natural mangroves (109.79 tonnes/ha). As carbon dioxide is likely to be released when areas are degraded to accommodate mangrove planting, such activities should be scientifically planned to avoid unintended consequences. It is therefore recommended that geomorphology, connections to other marine and coastal ecosystems, and the ability of mangroves to adapt to climate-change related environmental impacts should be central considerations in future afforestation projects.

Based on economic studies undertaken on these ecosystems in other parts of the world, the existing Blue Carbon ecosystems in Abu Dhabi likely provide services worth hundreds of millions of US dollars annually through shoreline stabilisation, support to fisheries, direct recreational use, and water-quality maintenance. Other non-market values such as biodiversity, the regional regulation of eco-systems, and cultural, spiritual, and aesthetic value must also be considered.

While the true economic value of these Blue Carbon ecosystems is still being determined, the opportunity costs of losing these ecosystems to degradation or development are undeniably significant. Initial findings indicate that the value of the carbon, together with the associated ecosystem services, has a combined Net Present Value (NPV) of US $1.66 billion to US $1.71 billion at a discount rate of 10 per cent, and of US $2.57 billion to US $2.63 billion at a discount rate of 5 per cent, based on a range of carbon prices from US $2 to US $10 per metric tonne of CO_2. (AGEDI, 2014).

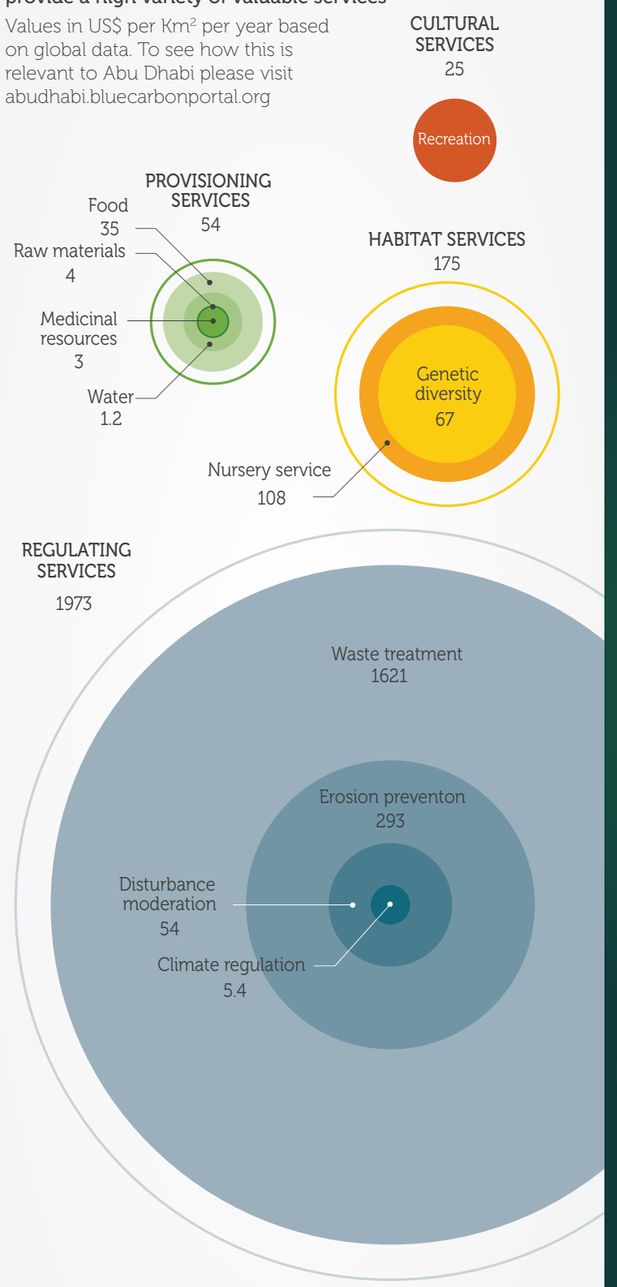
From studying Blue Carbon and the role that these ecosystems play in sequestering and storing atmospheric carbon, we were able to deepen our understanding of the valuable services that these ecosystems provide to our Emirate and its people. Through further targeted research, and in close consultation with key players in the Emirate and the UAE, we look forward to continuing our research to support science-based decision-making that helps us to build on the value of ecosystems to the people's well-being in the UAE. ■

DID YOU KNOW?

BLUE CARBON ECOSYSTEMS

provide a high variety of valuable services

Values in US$ per Km^2 per year based on global data. To see how this is relevant to Abu Dhabi please visit abudhabi.bluecarbonportal.org



Source: De Groot, R., et al., Global estimates of the value of ecosystems and their services in monetary units, Ecosystem Services, 2012.

هيئة البيئة - أبوظبي
Environment Agency - ABU DHABI

AGEDI
مبادرة أبوظبي العالمية للبيانات البيئية
Abu Dhabi Global Environmental Data Initiative

حكومة دبي
GOVERNMENT OF DUBAI

بلدية دبي
DUBAI MUNICIPALITY

المباني الخضراء
Green Building
دبي .. حيث يبدأ المستقبل
Dubai..Where Future Starts

دبي مدينة متحضرة بكل معانيها؛ مخضرّة مبانيها، لا يملك الناظر إليها من علٍ إلا أن يطلقَ أحاسيسَه، كأنه يرى معنىً آخرَ للجمال المطلق الذي يعيدُ للنفس طفولةً يحتاج إليها الهارب من زحمة المدنِ الكبيرةِ المفتقدةِ لعبق العشب الأخضر!. هذه هي مباني دبي!.
قصة المدينة ليست مجرد سرد لجمال وروعة المباني، وإنما هي قصة نقاء واستراتيجية نماء.. قصة التزام بلوائح وقوانين مقيدة بمواصفات عالمية، تتضمن: الاستدامة، الحفاظ على الطاقة والاستخدام الأمثل لها، عدم هدر المياه، التحكم بالملوثات البيئية ورقابة جودة الهواء والحد من انبعاثات الغازات المسببة للتغير المناخي... وغيرها. من أجل ذلك قامت بلدية دبي بتطوير استراتيجياتها لتتويج مباني المدينة بالأخضر.

رؤيتنا: بناء مدينة متميزة تتوفر فيها استدامة رفاهية العيش ومقومات النجاح.
Our Vision: Creating an excellant city that provides the essence of success and comfort of sustainable living.

DEWA'S EMISSION-REDUCTION PROGRAMME

ARTICLE



Dubai Electricity and Water Authority (DEWA) has a clear commitment to emissions reduction, in alignment with its vision to become a sustainable world-class utility. Sustainability requires that DEWA uses its resources as efficiently as possible, as well as in an eco-friendly manner. Doing this also generates long-term economic and social benefits. This in turn accords with the Green Economy for Sustainable Development initiative of HH Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, for a sustainable future for the UAE.

DEWA is measuring its own carbon footprint, with the support of the Dubai Carbon Centre of Excellence, and is now developing a carbon dioxide emission-reduction programme to set an emission-reduction strategy to enable it to adhere to the objectives of the Dubai Integrated Energy Strategy 2030. This programme has already seen positive results. DEWA's total carbon emissions in 2012 (in million metric tonnes of carbon dioxide equivalent ($MtCO_2e$), were 18.26 $MtCO_2e$, which has been verified as meeting the ISO-14064 standard. It is a reduction on the 18.29 $MtCO_2e$ emitted in 2011, with the majority of carbon dioxide emissions coming from the combustion of natural gas to generate power and desalinate water.

These improvements are based on DEWA's carbon-reduction strategy, which has five main pillars. The first is DEWA's supply-side energy-efficiency strategy, which will be addressed in greater detail later. In addition, DEWA focuses on low-carbon operations, investment in low-carbon and renewable-energy technologies to reduce the carbon intensity of its operations, registering Clean Development Mechanism projects to access carbon markets, and finally, the promotion of energy and water conservation.

To achieve emissions reductions, DEWA's supply-side energy-efficiency strategy is based on three main objectives. The first is investment in more efficient and reliable technologies for electricity and water generation, both for existing and new facilities. The second is the reduction of system losses in DEWA's transmission and distribution networks, and the third is the reduction of emissions and greenhouse gases from DEWA equipment and assets.

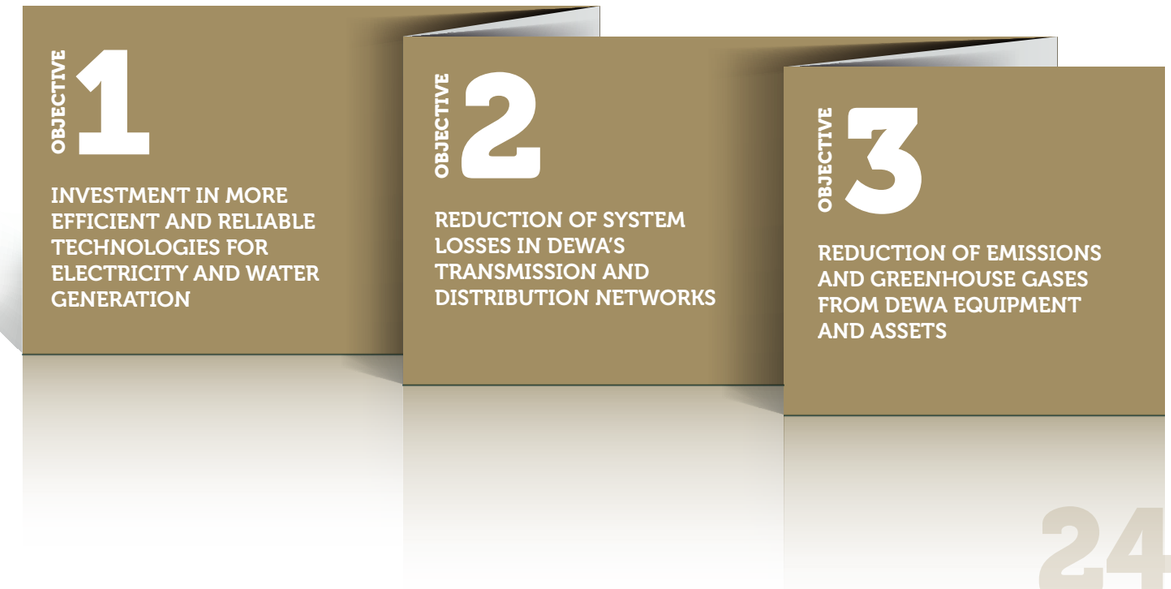
By providing electricity and water more efficiently, DEWA improved its cumulative efficiency by 26.9 per cent between 2006 and 2013. This was achieved by various measures, such as optimising power-plant designs (depending on power to water requirements), power augmentation by recovering lost power and efficiency during the summer months, optimised generation by shutting down generation units that are running at low-load levels and outage planning. Working to achieve these combined objectives has enabled DEWA to save 5.3 million tonnes of carbon dioxide.

One of the initiatives that helped achieve these successes was the Thermal Energy Storage Turbine Inlet Air Chilling (TESTIAC) project, a power-augmentation project that was the first of its kind to be implemented on a commercial scale anywhere in the world. TESTIAC was designed to overcome the loss of turbine capacity and efficiency occurring when ambient air temperatures rises significantly above ideal design conditions, which is common during Dubai's summer months.

In 2011, DEWA installed TESTIAC technology at three of its gas turbine units at Jebel Ali Power Station, with impressive results. The generation efficiency of the modified turbines increased by 7 per cent and the generation capacity increased by 20 per cent, while greenhouse gas emissions dropped by 7 – 9 per cent when compared with the baseline. The project capital cost was equal to 30 per cent of the market valued cost of conventional power plants. TESTIAC received a range of awards in recognition of this achievement, including the Dubai Government Excellence Program 2011–2012 Award (Distinguished Technical Project Category), and the IDEAS UK 2012 Award for Idea of the Year and Global Award.

DEWA also introduced wet-compression technology to eight gas turbines at two of its power plants in Jebel Ali. This technology injects atomised water droplets into the turbine air-inlet stream, which enhances the overall efficiency and power output of a gas turbine. This improved turbine efficiency by 3—5 per cent, increased generation capacity by 16—18 per cent and reduced nitrogen oxide emissions by 30—40 per cent at a project capital cost equal to 11—14 per cent of market value.

Along with generation, the transmission of electricity also needs to be considered as a means of reducing emissions – the more efficient the transmission and distribution network, the less fuel is required to generate electricity for the grid. DEWA is making substantial investments to reduce losses from its networks by building new substations and implementing its Intelligent Metering System and Smart Grid. These efforts to optimise the network resulted in the 2013 transmission line losses being only 3.46 per cent, compared to 6—7 per cent in the United States and the European Union. ■



ALUMINIUM INDUSTRY DRIVES STRONG SUSTAINABILITY AGENDA

OPTIMISING ENERGY CONSUMPTION TO REDUCE EMISSIONS

ARTICLE

By Saeed Al Mazrooei



DUBAL was awarded first place in the 2012 Gulf Aluminium Council ("GAC") Environment Awards and the 2013 Environmental Responsibility/ Stewardship Award.

It's not often you'll hear the words "energy efficiency" and "aluminium production" in the same sentence, and for good reason: Aluminium is an energy-intensive business. For UAE-based aluminium giant Emirates Global Aluminium PJSC (EGA), it's all about balancing these two imperatives as EGA contributes to both the UAE economy and its long-term energy solutions.

Indeed, as an industrial flagship and a major user of energy, EGA has a broader sustainability agenda that is seeing the company spearheading efforts to save energy and find alternative energy sources. EGA's aims are clear – namely to create an aluminium industry that is at the forefront of the UAE's efforts to diversify its economy beyond crude oil and natural gas sales, while continually reducing the impact of its operations on the environment and its surrounding communities.

There's no doubt that aluminium is an industry for the future. The metal is increasingly being used by the automotive industry to create lighter vehicles that meet stringent environmental demands, using less fuel and creating fewer emissions in the process. It has also become a staple of the building industry, where it has led to sweeping changes in building techniques through its lightness, flexibility and ability to be recycled.

EGA is determined to seize this opportunity. EGA's two operating subsidiaries in the primary aluminium sector – DUBAL in Jebel Ali, Dubai and EMAL's more modern smelter in Al Taweelah, Abu Dhabi – both count among the world's largest single-site primary aluminium smelters. However, EGA's plants aren't just among the biggest in the world – they are also among the most efficient.

Although both the DUBAL and EMAL plants have their own power stations and are essentially self-sufficient in terms of electricity, EGA is constantly looking for ways not only to conserve energy, but also to find alternative energy methods. This supports the Dubai Integrated Energy Strategy 2030 (DIES 2030), driven by the Dubai Supreme Council of Energy (DSCE), which targets efficient energy use to meet the Emirate's environmental and sustainability objectives. The latter includes a reduction in energy demand by 30 per cent by 2030 through optimised energy usage and diversification of the energy mix to reduce dependence on natural gas to 71 per cent by introducing nuclear and clean coal power stations (24 per cent) and solar power (5 per cent). DIES 2030, in turn, is aligned with the UAE Vision 2021, in terms of energy and sustainability – specifically the rational use of energy and water, promoting air quality, encouraging conversion of waste to energy, and developing clean and renewable energy, water security, sustainable transport and rational fuel use.

Through DUBAL, EGA is playing an active role in driving DIES 2030. This includes an investment of AED20 million in the Sheikh Mohammed bin Rashid Solar Park, which aims to produce 1,000 MW of power by 2030. In addition, the company is running feasibility studies around the establishment of clean coal-fired power stations in the UAE as alternatives to current power production, which is based on purchased pipeline natural gas.

The DUBAL Power Plant currently consists of 23 gas turbines and 7 steam turbines capable of generating up to 2,350 MW of power, while the EMAL Power Plant consists of 9 gas turbines and 4 steam turbines capable of generating up to 3,100 MW of power. The primary fuel source is purchased pipeline natural gas. However, the cogeneration and combined cycle configuration of the two power plants means that more than one-third of the power generated by EGA's operations is fuel-free through the steam turbines.

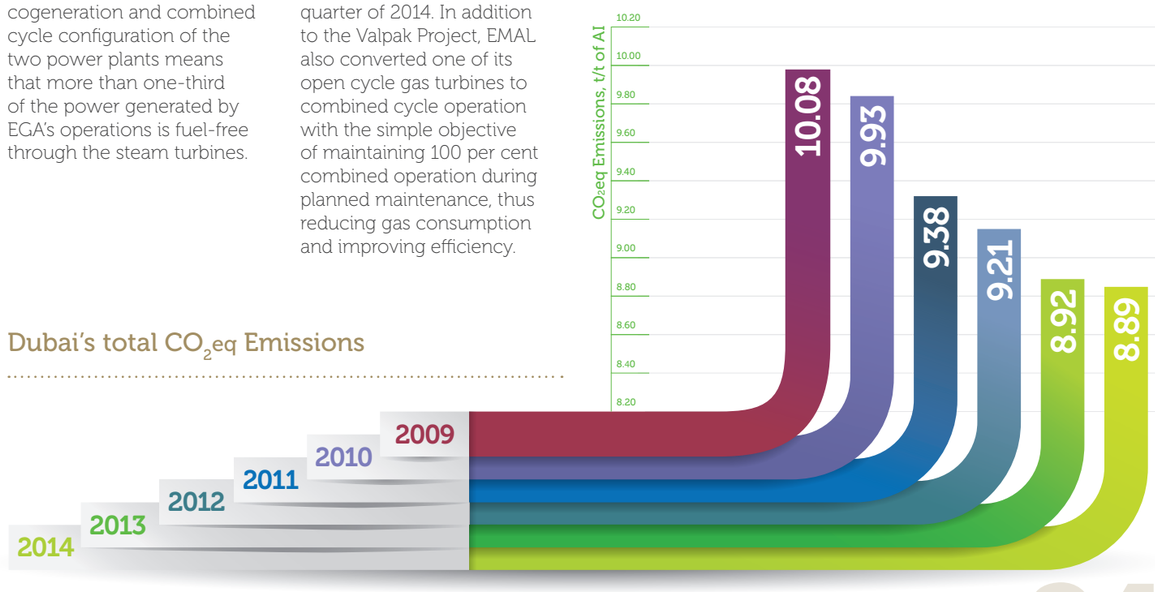
Thanks to innovations and upgrades, the thermal efficiency of the DUBAL Power Plant has improved significantly over the years and in 2013 was 46 per cent. This remarkable improvement has resulted in increased power generation to produce hot metal, while the fuel requirement increment is proportionately less. By comparison, the designed thermal efficiency of the newer EMAL power plant in 2013 was 52 per cent. In 2013, the efficiency figure recorded at the EMAL Power Plant was 47.85 per cent. This relatively low efficiency figure for 2013 is directly attributed to a multi-million dollar upgrade programme initiated by the EMAL Operations team for the Phase I gas turbines. To implement the programme, the standby open cycle turbines were brought into operation, thereby temporarily lowering the plant's efficiency figure. This programme, known as the Valpak Project and implemented by the turbine OEM, delivered major upgrades to the turbine compressor, combustion and cooling systems. The programme, which had the objective of improving the power plant efficiency cycle and reducing emissions, concluded during the second quarter of 2014. In addition to the Valpak Project, EMAL also converted one of its open cycle gas turbines to combined cycle operation with the simple objective of maintaining 100 per cent combined operation during planned maintenance, thus reducing gas consumption and improving efficiency.

By April 2014, CO_2eq emissions were approximately 1.19 million tonnes lower than in 2009.

The efforts of DUBAL's Power Plant alone resulted in fuel consumption being reduced by 6 million standard cubic feet per day between 2010 and 2013, with an associated decline in carbon dioxide emissions of 500,000 tonnes. This supports the comprehensive Carbon Management Strategy (CMS) developed by DUBAL in 2009. Aiming to achieve substantial reductions in greenhouse gas (GHG) emissions and thereby limit DUBAL's carbon footprint, the elements of the CMS include communication, awareness and brand image, data monitoring and targets, abatement projects, low-carbon marketing and procurement, a low-carbon technology roadmap and Go Low Carbon. As a result of implementing initiatives in these areas, total GHG emissions at DUBAL have declined significantly. By April 2014, CO_2eq emissions were approximately 1.19 million tonnes lower than in 2009, representing a reduction of almost 12 per cent from the 2009 baseline. The GHG emissions intensity also reduced from 10.08 CO_2eq/tonne aluminium in 2009, to 8.89 CO_2eq/tonne aluminium in April 2014.

The major GHG emissions reduction initiatives implemented in recent years as part of DUBAL's CMS have included the GTX Project, evaporative cooling, steam absorption chiller, smelter energy optimisation initiatives, the Perfluorocarbon (PFC) reduction project, regenerative burners and more. In addition, an Energy Optimisation Steering Committee has been formed and the ISO 50001 Energy Management System has been implemented (DUBAL's Power Plant being the first in the Middle East to achieve the standard). With regard to the low-carbon technology roadmap, DUBAL's in-house developed DX and DX+ Technologies achieve substantially lower energy consumption and GHG emission performances than other technologies of a comparable class. Both technologies have been installed at EMAL (756 DX Technology cells in Phase I; 444 DX+ Technology cells in Phase II).

Dubai's total CO_2eq Emissions



Importantly, several of DUBAL's GHG emission-reduction initiatives have been recognised by both regional and international platforms. DUBAL was awarded first place in the 2012 Gulf Aluminium Council (GAC) Environment Awards and the 2013 Environmental Responsibility/Stewardship Award in the inaugural Metal Bulletin Global Awards for Excellence in Aluminium for its efforts to reduce GHGs. DUBAL also won the 2013 Dubai Quality Group (DQG) Award in the Breakthrough Process Improvement Category for achieving a 50 per cent reduction in PFC Emissions from 2007 to 2012.

The DUBAL CMS also includes exploring potential Clean Development Mechanism (CDM) projects with the scope for substantial reductions in GHG emissions. The company has registered a project entitled 'Re-generative burners for casting furnaces' under CDM, through the United Nations Framework Convention on Climate Change (UNFCCC). This project aims to reduce energy consumption, following pilot studies indicating the potential to reduce gas consumption by 39 per cent, leading to an anticipated 10,000-tonne reduction in carbon dioxide emissions per year.

DUBAL is currently working with Dubai Carbon Centre of Excellence (DCCE) to update its CMS to include the new challenges and set the carbon mitigation plan for the coming years. This is complemented by active support for the UAE's efforts to optimise energy utilisation and diversify energy sources, including an investment of AED20 million in Sheikh Mohammed bin Rashid Solar Park.

Moreover, the installation of built-in dry low NOx burning systems in new GTs and retrofit of existing GTs reduced DUBAL's NOx air emission rate by 60 per cent between 1990 and 2010. Similarly, recent upgrades to EMAL's gas turbine combustion system have resulted in a 40 per cent reduction in NOx emissions.

Being self-sufficient in terms of generating its own power requirements has not stopped EGA from working continually to minimise the power consumption across its operations. Simply fitting energy-saving bulbs at the DUBAL smelter complex has resulted in a power-consumption reduction of 12,510 kWh per year, and motion sensors have been installed in many areas, especially in unmanned substations. A plant-wide, full scale LED lighting conversion is planned for implementation as soon as practicable. To minimise the air-conditioning load, the units' thermostats are set at 24°C during working hours and 27°C during non-working hours. These initiatives, which are in keeping with the directive issued by the Dubai Supreme Council of Energy (DSCE) in April 2012, led to DUBAL saving approximately 28 million MWh by the end of 2013.

Of course, no story about the innovative use of energy in the UAE is complete without a mention of DUBAL's Desalination Plant, which has been a major producer of drinking water for Dubai since the inception of the plant in 1979. The plant uses waste heat from DUBAL's power-generation operations to produce high-quality potable and distilled water using the Multistage Flash (MSF) evaporation process.

> "EGA's plants aren't just among the biggest in the world – they are also among the most efficient"





Up to 30 million imperial gallons per day (MIGD) can be produced, with the majority of the potable water produced being sold to external consumers (91.32 per cent in 2012). This sweet water is either distributed through the DUBAL Water Filling Station or supplied to adjacent industries through a series of pipelines.

The EMAL site also includes a desalination plant, which uses reverse-osmosis technology to produce up to 3.75 million gallons of fresh water per day. At this stage, this is largely used to meet the sweet-water needs of the plant itself.

Ultimately it comes back to sustainability, across every aspect of EGA's operations, from protecting the environment to using less energy and continually working to lower its emissions and carbon footprint. By contributing substantially to its communities and the local economy, both directly and indirectly, EGA is helping to building a sustainable future for the UAE and its people. ■

ABOUT SAEED AL MAZROOEI



He is CEO of UAE Operations at Emirates Global Aluminium, whose primary aluminium production capacity of 2.4 million tonnes/year is driven by captive power stations generating up to 5,450 MWh. A proponent of sustainability, he holds a BSc (Mechanical Engineering) and an MSc (Gas Engineering and Management).

BRINGING THE CARBON FOOTPRINT DOWN BIT BY BIT

HOW REDUCING CARBON EMISSIONS POSES A MAJOR BUT FRUITFUL CHALLENGE TO A LARGE TRANSPORT CORPORATION



CASE STUDY UAE

By Feryal Tawakul

The increasing collaboration between Emirates Transport (ET) and the Ministry of Environment and Water, and the adoption of a corporate strategy with sustainable services at its core, led ET to cooperate with Dubai Carbon in calculating the corporation's carbon footprint.

As one of the largest transport fleet operators, with over 12,000 employees at the time, the project was seen as an important step for the corporation in achieving its sustainable service objectives.

In 2012, working closely with specialists from Dubai Carbon, the Emirates Transport HSE department undertook the considerable challenge of collecting the required data. The results were a baseline carbon footprint of 157,877 tCO_2e.



Not surprisingly, transport activities accounted for the vast majority of the estimated emissions (97 per cent). The breakdown of the baseline by source reveals that the single largest contributor is the school transport segment which constituted 34 per cent of the total emissions. The second largest emitter is the governmental transport segment with 19 per cent.

Using the data as starting point, Emirates Ttransport looked into a strategy for GHG emissions reduction.

A combination of route planning and energy-efficiency solutions was identified as the best method to achieve carbon reductions within ET. In the long term, hybrid cars, biofuels and more compressed natural gas (CNG) operated vehicles are also options that will slowly be introduced.

ABOUT FERYAL TAWAKUL



She is the Executive Director of Corporate Services Division at Emirates Transport.

Other key efforts involved in reducing the carbon footprint include the following:

- **Water consumption reduction:** Mainly through the introduction of Dry Car Wash technologies, as well as water-conservation technologies in ET buildings.;
- **Noise level reductions:** Through performing periodical maintenance of noisy hardware, ensuring insulation of loud noise sources such as pump rooms, reducing the number of people exposed to noise, and raising awareness of noise and hearing protection.;
- **Reducing fuel consumption rate:** Mainly through inclusion of more fuel-efficient vehicles in the fleet to reduce overall fuel consumption. Emirates Transport has purchased EURO II buses (60- and 30-seaters) in order to reduce pollution. In addition, electronic tracking systems have been installed in more than 90 per cent of school buses and can be use to monitor fuel consumption.;
- **Paper saving:** By applying the concept of the paperless office –, using electronic communication channels, automated internal services, digitising documents and spreading awareness to reduce overall paper usage.;
- **Recycling of computers and peripherals:** The corporation collects all used computers and related-accessories and donates them to Dubai Municipality for recycling and reuse.;
- **Recycling of printer toners and ink cartridges:** The corporation also collects used printer toners and ink-cartridges for recycling. During 2013, 385 such components were recycled.;
- **Raising awareness:** The role of awareness cannot be underestimated or neglected, and the Departments of HSE and Government Communication at ET are committed to the education process which underpins achieving the corporation's green targets.

No doubt there will be many challenges in attempting to manage and reduce the carbon footprint, given the current and projected growth of the corporation. However, with a firm commitment to the UAE Vision 2021 and the Sheikh Mohammed bin Rashid Al Maktoum's Green Economy for Sustainable Development initiative, we are sure to pursue every viable avenue to live up to our responsibility as a federal corporation, and as a prominent player in the UAE transport and education sectors. ■

THE GLOBAL COALITION FOR GREEN SCHOOLS

HEALTHY ATMOSPHERES AND ENVIRONMENTS FOR THE UAE'S YOUTH

CASE STUDY UAE

By Aanal Patwari



> "Green schools are more than just buildings."

According to a report by UNEP (Buildings and Climate Change, 2009), it is estimated that approximately one-third of total global greenhouse-gas emissions originate from 'poorly designed' buildings during their operational phase. Due to the climatic conditions in the UAE, students and school staff spend a significant amount of time indoors. Poor maintenance of the buildings and their internal conditions can result in discomfort, poor pupil performance and people falling sick. According to a recent article published by The National (Poor air quality in UAE classrooms can harm children's health, June 21, 2014), a study conducted by researchers at the British University in Dubai discovered levels of air pollutants that exceeded the limits recommended by Dubai Municipality in the majority of the schools participating in the assessment.

Green schools are more than just buildings. They provide an atmosphere in which children can study and learn, which is why it is extremely important that schools are built in such a way to ensure clean air, sunlight and an environment free of harmful materials. Green schools not only improve the performance of those occupying them, they also save energy, resources and money.

According to the World Green Building Council, nearly 1.2 billion students learn in environments which are ill-equipped and can pose a threat to children. The UAE shares this global problem, and the Emirates Green Building Council, as a founding member of the Global Coalition for Green Schools, is coordinating closely with schools and working with local authorities to identify solutions. The Global Coalition was launched at the 2013 World Green Building Congress with the aim of reducing schools' ecological footprints, making school environments healthier and getting the entire community thinking about sustainable solutions for a better, healthier environment.

> "The thought that a student learns more readily in a healthy atmosphere isn't very controversial or debatable."

The National Coalition for Green Schools will complement existing practices already in place in the UAE, some of which include:

Environment Agency of Abu Dhabi

Sustainable School Initiatives, commenced in 2009

Al Madaris Al Mustadama or Sustainable Schools is an initiative that engages students, teachers, parents and administrative and maintenance staff in participatory projects to help reduce the school's ecological footprint. The main element of this initiative is involving the teachers in comprehensive educational techniques.

EWS-WWF

Eco School Programme, commenced in 2012

Eco Schools is an international initiative and environmental management tool that engages children in key environmental issues, including sustainability and low-carbon futures. To date, 50 schools have registered under the Eco School Programme in the UAE, of which 15 have been accredited.

Bee'ah Sharjah

Sharjah Environmental Awareness Award, commenced in 2010

Under the direction of H.H. Sheikh Dr. Sultan Bin Mohammed Al Qassimi, the Sharjah Environmental Awareness Award honours schools in Sharjah for their environmentally sustainable projects. It encourages teachers and students to work together to make their schools examples of sustainability best practice.While it may be difficult to measure the correlation between the quality of school buildings and a student's performance, it is widely accepted that students learn more effectively in a healthy atmosphere. A survey conducted by McGraw Hill Construction in 2013 on the benefits of green-school efforts stated that health and wellbeing are among the most important reasons to build, retrofit and operate greener schools. Implementing simple steps to improve energy and water performance, increase daylight, and enhance air quality can help reduce absenteeism and improve student productivity and test scores.

The Emirates Green Building Council is actively engaging with the UAE education sector as well as government and industry stakeholders to join hands and make a positive impact on schools and their important inhabitants. Contact the Emirates GBC to get involved and take part in the National Coalition for Green Schools..■



ABOUT AANAL PATWARI



She is the Education and Events Executive at Emirates Green Building Council. She is also an active member of OIKOS International for Sustainable Economics & Management.

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COMPANY PROFILES

DEWA IS FORMED....

The Dubai Electricity and Water Authority (DEWA) was formed on 1 January, 1992, by a decree issued by His Highness Sheikh Maktoum bin Rashid Al Maktoum to take over and merge the Dubai Electric Company and the Dubai Water Department that had been operating independently for several years until then. Both these organisations were established in 1959 through the foresight and initiative of His Highness Sheikh Rashid bin Saeed Al Maktoum, the late Ruler of Dubai, as government-supported bodies with the objective of making available to the people of Dubai an adequate and reliable supply of electricity and water.

AND TODAY....

Today, after near about five decades, DEWA is an inspiring success story known for its efficiency and reliability in every facet of its operations. Constant planning and forecasting to meet the growing demands of the customer has always been DEWA's well entrenched philosophy. Owing to this policy, the Authority has come a long way in serving the customers and thereby making its own contributions to the economic growth of Dubai.

Today DEWA employees a workforce of over 9,000 employees who constantly endeavour to see that both the quantity and quality of services provided are of the highest standards in consistency and reliability. In Dubai, DEWA provides over 600,000 customers with electricity and over 500,000 customers with water.

Thus the expansion continues in order to meet the ever growing demand for electricity and water, and keeping this in mind DEWA continues to maintain its corporate structure and functioning in the most professional and advanced ways to ensure its continued success in the years to come.

DUBAI SILICON OASIS

Dubai Silicon Oasis Authority (DSOA), which is owned 100% by the Government of Dubai, is the region's leading technology hub. In addition to a state-of-the-art infrastructure, DSO offers first-class business support, technology incubation facility, growth equity financing as well as full free zone benefits, creating the perfect environment for technology companies to thrive. As a result, DSO has become the destination of choice for a wide range of cutting edge technology players such as: Fujitsu, SAP, Avaya, Porsche, Western Digital and many more.

DSO's community spans over 7.2 square kilometres of state-of-the-art-office towers, R&D facilities, industrial zones, educational institutions, luxury apartments, villas, hotels, healthcare and a full range of lifestyle facilities which translate into a dynamic 'integrated' community where people can work, live and play.

DSO also offers an array of high-quality facilities to businesses operating within the technology park supported by advanced systems and latest technologies. Furthermore, DSO ensures an eco-friendly and clean environment with buildings being constructed in line with global energy saving standards, while carrying out daily maintenance to ensure an ideal business environment.

DSO facilities include:

- Plug and play office space;
- Multiple-Use Warehousing and light industrial units;
- Land for development

Become a member of DSO's hi-tech community and benefit from the one-stop-shop-business services right at your doorstep including:

- Business Registration and Licensing;
- Customs Clearance;
- Municipal Services and Building Certification;
- Immigration Services and Employee Visa Processing;
- Postal Services; and more.

Free Zone Benefits include and are not limited to the below:

- 100% foreign ownership
- 100% repatriation of capital
- Zero income tax
- Zero corporate tax
- No import or export tax
- State of the art IT infrastructure
- Fast-track business set-up and licensing

EMIRATES GLOBAL ALUMINIUM

Emirates Global Aluminium PJSC (EGA) is a jointly held, equal-ownership company formed by the Mubadala Development Company of Abu Dhabi and the Investment Corporation of Dubai by combining their respective aluminium industry assets. EGA's core operating entities are Dubai Aluminium PJSC (DUBAL) and Emirates Aluminium PJSC (EMAL), whose combined annual production capacity is set to reach 2.4 million tonnes per annum (tpa) by mid-2014, which will make EGA one of the leading aluminium producers in the world. The UAE-based EGA also owns Guinea Alumina Corporation (GAC), a strategic bauxite mine and alumina refinery development project in Guinea, West Africa. In addition, EGA has plans for significant local growth and international expansion.

DUBAL, where commissioning began in 1979, operates one of the world's largest single-site primary aluminium smelters. The DUBAL complex, built on a 4.75 square kilometre site in Jebel Ali, Dubai, comprises a 1 million tpa smelter, a 2,350 MW power station (at 30˚C), a large carbon plant, extensive casting operations (more than 1.2 million tpa), a water desalination plant, a dock and other facilities. A quality-focused, customer-centred and innovation-driven organisation, DUBAL holds ISO 9001, ISO 14001, ISO/TS 16949, ISO/IEC 20000-1, ISO/IEC 27001, ISO 29990, ISO 50001 and OHSAS 18001 certification; and is accredited to ISO/IEC 17020.

EMAL is designed to become another of the world's largest single-site primary aluminium smelters. The EMAL complex, housed on a 6 square kilometre site in Al Taweelah, Abu Dhabi, was built in two phases. Phase I, which was fully commissioned by the end of 2010, is the world's largest greenfield smelter development and currently has a smelter capacity of 800,000 tpa. Commissioning of Phase II, comprising the world's single-longest potline (444 cells) with a design capacity of 520,000 tpa, began mid-September 2013. Full ramp-up was achieved mid-June 2014, giving EMAL an annual hot metal production capacity of 1.3 million tpa. EMAL holds ISO 9001 accreditation and Nebosh certification in Occupational Health and Safety.

The combined DUBAL-EMAL portfolio comprises high quality aluminium products in four main forms: foundry alloy (automotive applications); billet (construction, industrial, transportation and automotive forging); high purity aluminium (electronics and aerospace); and sheet ingot (packaging, lithographic sheets and the automotive industry). Busbars and anode bars are also made for the electrolytic process used to produce primary aluminium from alumina ore. Over 350 customers are served in at least 64 countries, predominantly in Asia, Europe, the MENA region and the Americas.

As an industrial flagship and a major user of energy, EGA has a broader sustainability agenda that is seeing the company spearheading efforts to save energy and find alternative energy sources. Its aims are clear: to create an aluminium industry that is at the forefront of the UAE's efforts to diversify its economy beyond crude oil and natural gas sales, while continually reducing the impact of its operations on the environment and its surrounding communities.

ROADS & TRANSPORT AUTHORITY

The Roads and Transport (RTA) came into existence in November 2005 post the decree No.48 issued by Late Sheikh Maktoum Bin Rashid Al Maktoum which included the appointment of H.H Sheikh Mohammed Bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, as the President of the newly formed Roads and Transport Authority (RTA).

On its establishment, H.E Mattar Al Tayer, was appointed as the Chairman of the Board and Executive Director of the RTA. H.E. Al Tayer heads the Board of directors of the authority that consists of five agencies namely; the Traffic & Roads Agency, Public Transport Agency, Licensing Agency, Rail Agency and Dubai Taxi Corporation in addition to three support sectors which are: Strategy & Corporate Governance, Corporate Administrative Support Services, and Corporate Technical Support Services. The RTA's Board of Directors oversees its administrative, technical & financial affairs, develops the overall policy & project programs, prepares budget proposals for onward submission to the Executive Council of Dubai Emirate for endorsement, sets up Organization Charts, endorses fares structure for transportation& others, and appoints auditors.

RTA's Chairman of the Board is the Executive Director of the RTA who runs all RTA affairs including the implementation of decisions & policies developed by the Board, supervising the business of the executive body, preparing annual budgets, proposing Organization Charts as well as financial & administrative regulations, overseeing the business of RTA-affiliated agencies, and exercising any other powers entrusted to him by the Board or pursuant to any enacted law.

Pursuant to the Decree, all rights, obligations, responsibilities and powers of the Roads Sector, Dubai Metro Sector, Public Transport Dep't, Roads Maintenance Section and Street Lighting Unit have been transferred from the General Maintenance Dep't, Dubai Municipality to the RTA. Equally, the Traffic Engineering, Traffic Safety, Vehicle Licensing, and Drivers Licensing Sections as well as Plates Factory have all been transferred from the General Directorate of Traffic, General HQ of Dubai Police to the RTA.

All the sectors & agencies of the Roads & Transport Authority have obtained Assets Management Certification PAS 55 presented by the British SGS Group, becoming the first government department or authority in the Middle East to obtain this international certificate.

The entity is responsible for planning and providing an integrated transport system in the Emirate of Dubai, and between Dubai and other Emirates of the UAE capable of achieving Dubai's vision & serving the vital interests of the Emirate. In this context, it enacts rules& regulations and draws up comprehensive strategic plans related to road systems as well as land & marine transit networks to keep pace with Dubai's economic development plans aligned with the highest international standards. Its roles also include developing and implementing policies necessary for achieving optimal utilization of all existing transport & traffic elements such as roads, buses, and trains among others. It also attends to studying and endorsing the privatization of some RTA-related business, in addition to establishing, managing & commissioning an integrated transport system that provides services customized to community needs & segments. It sets up regulations as well as administrative & operational systems relating to its core business.

The RTA also compiles and implements findings of studies conducted for fixing and implementing fees applicable to traffic & roads including proposing fees for using roads network, licensing drivers & vehicles, and setting fares structure for mass transit routes. It also attends to upgrading legislations & procedures of drivers & vehicles registration & licensing in a way that realizes the strategic objectives of transport system in the Emirate, and conducts licensing of mass transit routes as well as all activities related to RTA business.

Managing the strategies and needs of the transport sector in Dubai is an important task that the RTA has, and being an independent authority in terms of its administration and management, it is legally authorized to do everything which will help it achieve its vision of 'Safe and Safe Transport for all'.

Since its establishment in 2005, the entity has achieved numerous accolades by constructing and operating key turnkey road and transport projects. These include the 75 kms Dubai Metro which is the longest driverless Metro in the world, increasing safety and reducing pedestrian fatalities to 8 per 100,000, expanding the road networks by 29% with the construction of parallel roads and creek crossings and implementing around 116 routes which are served by a fleet of over 1550 buses. On the marine front, the entity has introduced an array of water transport modes which include the Dubai Ferries, water taxis, and water buses to complement the traditional wooden 'Abras' that have known to channel the Dubai creek since time memorial.



ABOUT TAQA

TAQA means "energy" in Arabic. We are an international energy and water company listed in Abu Dhabi and operating in 11 countries across four continents.

We strive to run our company safely and sustainably, operating to the highest ethical standards.

Our interests lie in conventional and alternative power generation, water desalination, oil and gas exploration and production, pipelines and gas storage.

We operate in Canada, Ghana, India, Iraq, Morocco, the Netherlands, Oman, Saudi Arabia, the United Arab Emirates, the United Kingdom and the United States.

We are proud to align our strategy to Abu Dhabi's Economic Vision 2030, a roadmap for a sustainable economy with a focus on knowledge-based industry. TAQA supports the Abu Dhabi Economic Vision 2030 in the areas of:

- Economic development
- Social and human resources development

ECONOMIC DEVELOPMENT

TAQA helps ensure the security and resilience of Abu Dhabi's economic growth by maintaining and investing in new power and water desalination infrastructure. TAQA supplies one of the engines of Abu Dhabi's growth, keeping up with the growing power and water needs of the emirate.

Around the world, TAQA is active throughout the entire value chain, from oil and gas exploration and production through to power generation and water desalination. These global operations facilitate the export of capital through targeted investments and contribute to TAQA's robust financial performance, which in turn delivers dividends to shareholders and other stakeholders in Abu Dhabi.

SOCIAL AND HUMAN RESOURCES DEVELOPMENT

TAQA is a sophisticated global energy company with operations in 11 countries and a workforce of approximately 2,800. We are able to offer outstanding opportunities for our employees to prosper in a competitive international setting. TAQA makes a long-term commitment to its employees and offers a diverse and compelling environment to deliver outstanding performance.

From our headquarters in Abu Dhabi, TAQA extends a unique opportunity to UAE Nationals to build a career in the global energy industry, acquiring skills and intellectual capital that will contribute to Abu Dhabi's goal of developing a high-value, knowledge economy. The knowledge acquired in a career with TAQA will directly benefit Abu Dhabi as it explores opportunities in state-of-the-art power and water facilities, complex oil and gas operations and alternative energy sources.

For further information, please visit: www.taqaglobal.com.

OPOWER

Opower combines a cloud-based platform, big data and behavioral science to help utilities around the world reduce energy consumption and improve their relationship with their customers. We provide customers personalised information through a variety of communication channels – including web, email, text, phone calls and mail – as well as tips for how to save energy. This helps consumers lower their energy use and costs, and significantly reduces carbon emissions.

Opower's four solutions – energy efficiency, customer engagement, demand response and thermostat management — are specifically designed to meet the regulatory and commercial requirements of utilities across North America, Europe, Middle East and Asia. We work with over 93 utility partners, including 27 of the 50 largest U.S. electric utilities, and reach more than 32 million households and businesses across eight countries. Clients in Europe include E.On, First Utility and EDF. In Asia, we work with TEPCO.

Founded in 2007 and listed on the NYSE as #OPWR, Opower is headquartered in Arlington, Virginia, with offices in San Francisco, London, Singapore and Tokyo. For more information, please visit www.opower.com and follow us on Twitter at @Opower.

DUBAI MUNICIPALITY

Dubai Municipality was established in 1954 starting its activities with only seven employees and undertaking simple tasks aimed at keeping the city clean.

The first decree establishing the municipality was issued on February 28, 1957. Based on this decree, 23 individuals from senior citizens and traders in the Emirate were appointed as members of the municipal council, with limited powers such as taking care of the affairs of health, construction and beautification of the city, as well as to provide constructive suggestions to the government.

Dubai Municipality has passed through a series of evolutionary stages in its proud history of development. Its development and growth coincided with the growth of the Emirate of Dubai. Currently it has 13,000 employees in 33 departments.

The civic body encompasses six major sectors, namely: Institutional Support, International Affairs & Partnerships, Engineering & Planning, Environment & Public Health Services, and Environment & Public Health Monitoring.

Thus Dubai Municipality is one of the largest government institutions in terms of its services, projects and activities , leading the growth and evolution of the Emirate of Dubai.

DOLPHIN ENERGY

The Dolphin Gas Project of Dolphin Energy Limited is a major regional strategic energy initiative. Since July 2007, the company has been producing, processing and supplying substantial quantities of natural gas from offshore Qatar to the United Arab Emirates via its dedicated sub-sea export pipeline.

Production reached the maximum authorised throughput of 2 billion standard cubic feet of gas per day (scf/day) in February 2008, and delivery of natural gas to Oman started in October of the same year.

The overall investment in constructing the entire Dolphin Gas Project – wells, sea lines, processing plant, export pipeline, receiving facilities and the UAE Gas Network – has made it one of the largest energy-related ventures ever undertaken in the Middle East at a cost of US$5.8 billion.

Dolphin Energy supports the development of substantial long term new industries throughout the region, creating sustainable wealth, economic growth and employment opportunities for citizens far into the future.

Dolphin Energy Limited is owned 51 percent by Mubadala Development Company, on behalf of the Government of Abu Dhabi, and 24.5 percent each by Total of France and Occidental Petroleum of the USA.

Detailed information about Dolphin Energy can be found on www.dolphinenergy.com.

EMIRATES TRANSPORT

Emirates Transport was established pursuant to Federal Law No. 17 of 1981, with the purpose of regulating, managing and supervising the operation of transport and maintenance services for various government, federal and local entities as well as private sector organisations.

ET pursues a strategy of achieving the highest quality in the transport and related auto services sectors throughout the UAE. This strategy is implemented through 19 business centres, 7 subsidiary organisations and 41 locations across the UAE, where ET provides services to more than 300 main stakeholders through its fleet of over 13,500 vehicles.

Emirates Transport has a proud record in corporate social responsibility, with an emphasis on community support and a firm commitment towards sustainable business practices, which has won the corporation a number of prestigious national and international awards.

Besides being the sole provider of transport services to all public schools in the country, ET also provides services in the following areas:

Private schools transport - Staff transports - Vehicle and driver transport services - Limousine/ luxury transport - Logistics transport - Comprehensive auto services - Vehicle inspections - Maintenance and repair service for heavy equipment and trucks - Sale of used vehicles - CNG vehicle conversion - Facilities management - Transport advertising services - Taxi services.

ENOC: BEHIND EVERY SUCCESSFUL JOURNEY

Emirates National Oil Company (ENOC), a wholly-owned entity of the Dubai Government, is a leading force in the economic diversification and sustainable development of the UAE.

Established in 1993, ENOC's primary focus has been to develop downstream and upstream activities in the oil and gas sector. Over the years, ENOC has expanded into several high-growth business sectors to create long-term value for its stakeholders.

ENOC's vision is to be a leading integrated oil and gas group that is highly profitable and socially responsible towards its employees, the communities it serves in and the environment.

With over 30 active subsidiaries and international joint ventures, the Group's business portfolio includes refining, oil trade, terminalling & storage, bunkering, liquefied petroleum gas, aviation fuel marketing, lubricants blending & marketing, informational technology, with core operations in the Middle East, Asia, Europe and Africa.

The winner of several international awards for quality, environmental sustainability and service standards, ENOC operates a network of ENOC and EPPCO service stations and is also credited with launching the Middle East region's first 'green service station.' The retail network features branded convenience stores, car wash, oil change and overall vehicle maintenance facilities.

Corporate Social Responsibility (CSR) is a fundamental purpose and value at ENOC. Human Fuel, which aims to raise funds for the United Nations World Food Programme (WFP) and Dubai Charity Association to address global hunger, is one of ENOC's key CSR initiatives.

ENOC is a strong participant in environmental protection, community development and health & safety awareness. Emirates Gas, a wholly-owned subsidiary, promotes Compressed Natural Gas as clean and green fuel of choice that supports the 'Green Economy for Sustainable Development' vision of the UAE.

ENOC has over 6,000 employees globally and strives to attract, develop and retain top talent to become the employer of choice, while adopting latest technologies and implementing best practices to achieve world-class performance.

Apart from providing the energy behind Dubai's phenomenal growth, ENOC is proudly associated with quality, service efficiency, sustainability and a deep-rooted partnership with the community.

Committed to the highest standards of business ethics and integrity, ENOC keenly abides by its 'Code of Business Conduct,' based on the core values of Team Work, Integrity, Transparency, Respect and Customer Focus.

Recognised as a 'Superbrand,' ENOC is the energy 'behind every successful journey.'

PÖYRY PLC

Pöyry Plc is an international consulting and engineering company. We serve clients globally across the energy and industrial sectors and locally in our core markets. We deliver strategic advisory and engineering services, underpinned by strong project implementation capability and expertise. Our focus sectors are power generation, transmission and distribution, forest industry, chemicals and biorefining, mining and metals, transportation and water. We have an extensive local office network employing about 6,000 experts. Our net sales in 2013 were EUR 650 million and the company's shares are quoted on NASDAQ OMX Helsinki (Pöyry PLC: POY1V).

Pöyry Management Consulting provides leading-edge consulting and advisory services covering the whole value chain in energy, forest and other process industries. We employ over 400 staff globally. Our energy practice is a leading provider of strategic, commercial, regulatory and policy advice to participants in energy markets, offering unparalleled expertise in the rapidly changing energy sector. Our energy practice consists of 200 specialists, located across 15 offices in 13 countries.

INSINKERATOR WHO WE ARE

InSinkErator is a business unit of Emerson Electric Co. and the inventor and world's largest manufacturer of food waste disposers and steaming hot water taps for home and commercial use. The company offers a high performance line of disposers known as the 'Evolution Series', a key range of food waste disposal systems that integrate advanced sound, grind, anti-jam and anti-vibration technologies into their design. InSinkErator's diverse portfolio of products includes basic disposer units, instant hot water dispensers and food waste pulper systems – units that can be used both at home or on a more professional food service level.

> The Ministry's functions focus on contributing to sustainable development, coordinating and representing petroleum affairs, minerals, electricity and water, and is charged with the responsibility of assuring that these resources are utilized to support the national economy in a pioneering and exemplary fashion in collaboration with other relevant authorities

HE Suhail Al Mazrouei
UAE Minsiter of Energy

Find out more about the UAE Ministry of Energy and its team, the UAE State of Energy Report 2015, the UAE Greenhouse Gas Inventory and much more on www.moenr.gov.ae.

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