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“The UAE was recently ranked 6th internationally for the overall quality of its infrastructure in the annual Global Competitiveness Report issued by the World Economic Forum. We have advanced global rankings for our world class network of roads, airports and our telecommunications and electricity infrastructures. Our goal in the coming years is to lead the global index of the quality of infrastructure.”

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

CHAIRMAN OF THE DUBAI SUPREME COUNCIL OF ENERGY

Since the formation of the United Arab Emirates in 1971, energy and natural resources have been closely linked to its growth. Today, sustainable energy has become a key factor in our efforts to promote economic, environmental and social growth, and the key driver for sustainable development and the preservation of the environment.

The Dubai Supreme Council of Energy is tirelessly working to achieve the initiative of HH Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, entitled 'Green Economy For Sustainable Development,' to promote the use of renewable sources of energy. The Supreme Council of Energy has formulated the Dubai Integrated Energy Strategy 2030, with the purpose of diversifying sources of energy, so that by 2030, gas will provide 71% of Dubai's total power output, nuclear energy will provide 12%, Clean Coal 12%, and Solar Energy will provide 5%. We are also working to reduce energy demand by 30%.

The Council organised the Dubai Global Energy Forum in 2011 and in 2013, to highlight the most prominent issues of energy, environment and sustainability. Other issues discussed included the exploration of the best practices in the fields of oil, gas, clean coal, and renewable energy, the peaceful use of nuclear energy, existing currently-applied policies, and future opportunities for improvement in this vital sector.

We have made practical strides to make these plans a reality, and the Supreme Council of Energy completed the first phase of the Mohammed bin Rashid Al Maktoum Solar Park, which has a generation capacity of 13 megawatts. This mega-project will be a good example to follow in the field of renewable energy.

I would like here to refer to the annual State of Energy Report, Dubai 2014, which has been launched by the Supreme Council of Energy. This report is one of the key factors of continuous progress to achieve the objectives of the Dubai Integrated Energy Strategy 2030. This report defines the key issues, required plans and important analysis of the sustainable energy sector in Dubai. This will help achieve and implement the best solutions for energy sustainability, while taking into consideration the relevant environmental issues. The report also provides experts, professionals and decision makers in both the public and private sectors with a stimulus to achieve the objectives of the Dubai Integrated Energy Strategy 2030. Most importantly, this report sets criteria for international best practices related to sustainable energy in the UAE and the entire world, which is a key and fundamental objective tackled by last year's World Energy Forum held in Dubai and the RIO+20 Summit held last year in Brazil. This constitutes a commitment to achieve a brighter and more sustainable future for all of us.

We appreciate the considerable efforts made by all the member companies of the Supreme Council of Energy, and we look forward to achieving the objectives of this report. We are convinced that we can build a firm basis for sustainable energy in the future.

Assalamu Alaikum Wa Rahmatullahi Wa Barakatuh

FOREWORDS

BAN KI-MOON

SECRETARY GENERAL OF THE UNITED NATIONS

> Energy is critical to everything we do, from powering our economies to achieving the Millennium Development Goals, from combatting climate change to underpinning global security. It is a golden thread connecting economic growth, social equity and preservation of the environment.

OPENING REMARKS TO THE 2012 WORLD FUTURE ENERGY SUMMIT, UAE

FOREWORDS

HE SAEED MOHAMMED AL TAYER

VICE CHAIRMAN OF DUBAI SUPREME COUNCIL OF ENERGY

MD AND CEO OF DUBAI ELECTRICITY AND WATER AUTHORITY

HH Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, emphasised his directives during his visit this year to Dubai Electricity and Water Authority's (DEWA's) Sustainable Building at Al Quoz on, "the importance of developing the electricity and water sector as well as the necessity to protect them against depletion for future generations." The Dubai Supreme Council of Energy, chaired by HH Sheikh Ahmed bin Saeed Al Maktoum, is making great strides in the field of sustainability, in line with the Dubai Integrated Energy Strategy 2030, which aims to diversify energy sources, rationalise consumption, conserve our natural resources, and preserve the environment.

The 'Dubai Declaration of Energy for All' was adopted to constitute an international document that tackles different issues in the field of energy to be resolved the following year at the second session of the Dubai Global Energy Forum (DGEF 2013) that took place last April. This, and other activities, have contributed to the range of programmes that reflect the relentless pursuit and great strides made by the Emirate, both nationally and globally, to secure clean and sustainable energy for all.

DEWA, as one of the key members of the Supreme Council of Energy, has made several leading achievements in different fields of energy, including elevating production and operational efficiency to record global levels, reducing electricity and water losses in line with world-class best practices, implementing smart grids, launching conservation campaigns, programmes and green buildings, and its opening the largest public-sector sustainable building in the world.

This report sheds light on the Energy Sector in Dubai. I trust that you will enjoy reading it and find it useful.

HE DR. RASHID AHMAD BIN FAHAD

UAE
MINISTER OF
ENVIRONMENT
AND WATER

We have come a long way in the United Arab Emirates for the past few years to meet the challenges of energy and climate change, within the framework of the ambitious national vision and clear strategic plans depends increasingly on knowledge, innovation and creativity, based on the diversification of energy sources and promote energy efficiency and conservation, to this end UAE adopted a variety of policies and initiatives such as: the development of the oil industry to minimize negative impacts by adoption of modern technology and best practices, options for renewable energy, alternative energy, carbon capture and storage techniques, adopting criteria for green buildings and sustainable transport, national standards to promote energy efficiency, promoting awareness of the importance of energy conservation and reduction of carbon footprint resulting from various types of activities, and finally the green economy approach is a holistic framework for all stakeholder and initiatives relating to sustainable development in the UAE.

The Ministry of environment and water, at present is developing a road map for implementation for national and sectorial approach for transformation to green economy based on the UAE strategy for green development which have been announced by His Highness Sheikh Mohammed bin Rashid Al Maktoum, UAE Vice President and Prime Minister, and Ruler of Dubai, the strategy is keen to strengthen national efforts aimed at the sustainability of the energy sector and address the challenges related to this sector, and in particular climate change.

The successful experience of the UAE in the mobilization of efforts and to promote integration between the various development policies towards the sustainability of the energy sector in the UAE, is worthy of contemplation, and opens the door widely of hope to apply in many areas down to the sustainability of the energy sector at the global level.

FOREWORDS

HE REEM EBRAHIM AL HASHIMY

UAE MINISTER OF STATE AND MANAGING DIRECTOR OF DUBAI EXPO 2020 HIGHER BID COMMITTEE

As a centerpiece of the UAE vision and policy, sustainability is also naturally at the core of Dubai Expo 2020. It is the thread that weaves together all aspects of our Expo's project: from its overarching philosophy and core theme to the physical design and operations of the Expo site. In the lead up to 2020, Dubai Expo is striving to set new benchmarks for the sustainability of mega-events through a range of innovative initiatives aimed at delivering a fully carbon neutral program. Every aspect of the event's delivery will seek to establish new benchmarks in our commitment to environmental consciousness. At the same time, the World Expo, with its capacity to convene and reach out to millions of people in the UAE and around the world, is a powerful tool for public education on sustainability. New behaviors and practices for greater environmental citizenship will permeate to our communities and last far beyond the event itself.

HELEN CLARK
ADMINISTRATOR
UNITED NATIONS
DEVELOPMENT
PROGRAMME

Sustainable energy is an enabler of sustainable development, poverty reduction and economic growth. At the same time clean energy has a key role to play in the fight against global warming by enabling reductions in greenhouse gas emissions. As a cornerstone of sustainable development, energy has emerged as a major topic in the post-2015 discussions. Given its central role in sustainable development, the United Nations General Assembly has declared 2014 to 2024 as the Decade for Sustainable Energy for All.

The launch of the United Nations Secretary-General's initiative 'Sustainable Energy for All' (SE4ALL) provides an opportunity to address the challenges by pursuing three goals to be achieved by 2030: to achieve universal access to energy, to double the rate of improvement in energy efficiency, and to double the share of renewables in the global energy mix.

Significant progress has been made in expanding access to electricity and energy services in the last twenty years, bringing electricity to an additional 1.7 billion people and securing access to generally less polluting, non-solid fuels for 1.6 billion people. There are still, however, 1.2 billion people who remain without access to electricity, and 2.6 billion who are using wood, charcoal and dung for cooking and/or heating. There is much more work to be done to bring sustainable energy benefits to all.

New approaches and ideas are emerging to make sustainable energy, including off-grid renewable energy technologies, more affordable and accessible for the poor, and to bring electricity to households, communities, and enterprises while reducing the overall carbon footprint. While market-based solutions will play a significant role in transforming energy systems in urban and rural areas, they will need to be complemented by a strategic use of domestic and international public funding.

Most governments, development partners, the private sector, and civil society organisations agree that a menu of approaches from large-scale investments to institutional sector and policy reforms, and 'bottom-up' solutions, including off-grid, small-scale, decentralised and community-based sustainable energy services, are needed.

The experiences from the UAE, which are presented in this publication contribute to a growing body of knowledge which is informing the national, regional, and global policy dialogue on energy, sustainable development, and climate change. The publication highlights the importance of partnerships between the public and private sectors, pointing to opportunities for making the transition to a low carbon development and sustainable energy.

The Rio +20 outcome documents, the SE4ALL initiative, the establishment by the UN General Assembly of the Decade for Sustainable Energy for All, and the on-going discussions on a post-2015 development agenda all provide opportunities and entry points for national governments, development partners, the private sector and civil society to accelerate the transition towards sustainable energy solutions – with the aim of eradicating poverty in the world and nurturing a more sustainable future.

I believe that this publication will contribute to the efforts of building a sustainable and shared common future.

ENDORSEMENT

DR. THANI AL-ZEYOUDI

When the UAE – an oil and gas superpower – takes leadership in clean energy, the global community takes notice. The work of the Dubai Supreme Council of Energy is a key part of our country's transformation. Dubai is taking important steps for change, including targets for energy efficiency and renewable energy, green building codes, establishment of a GHG mitigation unit, and public awareness campaigns. At the Ministry of Foreign Affairs, we are proud to communicate these kinds of initiatives to the world. They are the concrete actions that drive market growth for clean technologies and reinforce the UAE's reputation as a global energy hub. Building on the exciting initiatives in Dubai and the other emirates, the UAE is working collaboratively with the International Renewable Energy Agency, UNDP, and other global partners to demonstrate that a clean energy revolution is not only essential, but possible and profitable – and that our country is ready to be its champion.

DR. THANI AL-ZEYOUDI
DIRECTOR OF ENERGY AND CLIMATE CHANGE
MINISTRY OF FOREIGN AFFAIRS

NOTE FROM EDITOR IN CHIEF

BY MICHAELA NEUKIRCH

WELCOME

WELCOME TO THE FIRST EVER 'STATE OF ENERGY REPORT'.

The initiative stemmed from a somewhat unexpected source; a formal meeting between United Nations Development Program (UNDP), Dubai Supreme Council of Energy (DSCE) and Dubai Carbon. More specifically, the efficiency-focused report was initially conceptualised by HE Saeed Al Tayer. In discussion with former United Nations (UN) Resident Coordinator/UNDP Resident Representative Paolo Lembo and Dubai Carbon's CEO Ivano Iannelli, the full idea for the 'State of Energy Report' was brought to life.

This report represents our commitment towards leading the way to a green economy for sustainable development. There has been great support and feedback from UAE Governmental entities, the private sector, the UN and organisations including the International Renewable Energy Agency (IRENA), the World Bank (WB), the UAE branch of the World Wildlife Fund for Nature (EWS-WWF) and the International Energy Agency (IEA).

In 2012 the region welcomed international authorities and thought leaders on all matters related to sustainable development within energy, with Dubai hosting the World Energy Forum for the first time outside the UN headquarters and Qatar facilitating the Conference of Parties (COP18), in collaboration with United Nations Framework Convention on Climate Change (UNFCCC). The 'State of Energy Report' is a natural development, moving the topics that have driven these forums into a printed summary and analysis.

In the beginning, we used the rather abstract term 'knowledge product'. However, the full reality of what the report entails – a reflection of Dubai's efforts of approaching sustainability in various fields - only began to really unfold during our work on the content plan. The seven chapters exploring the Supreme Council's key thematic areas emerged from this line of thinking – as a platform for the exchange of best practices and innovation.

It should be noted that this report includes a topic not commonly discussed in the sustainability nexus: mega events. Dubai has made passionate commitments in its bid to host the World Exposition in 2020, and for the first time in Expo history, sustainability targets have been set. In the hopeful scenario that Dubai is selected as the host city, it will clearly signal a new era for resource management in the Emirate and serve as a benchmark for energy-efficient, large-scale events. This, and more, is outlined in Chapter Seven.

MICHAELA NEUKIRCH
EDITOR IN CHIEF

We keep our fingers crossed to see the Expo 2020 hosted in Dubai. Indeed, this would confirm Dubai's journey towards adopting a green economic framework. The UAE thrives under such challenges.

I sincerely hope you enjoy the read and that we will all be able to celebrate together the successful Expo 2020 bid in November, Insh'Allah.

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حكومة دبي
GOVERNMENT OF DUBAI

Under the Patronage of His Highness Sheikh Hamdan bin Rashid Al Maktoum,
Deputy Ruler of Dubai, Finance Minister of the UAE and President of DEWA.

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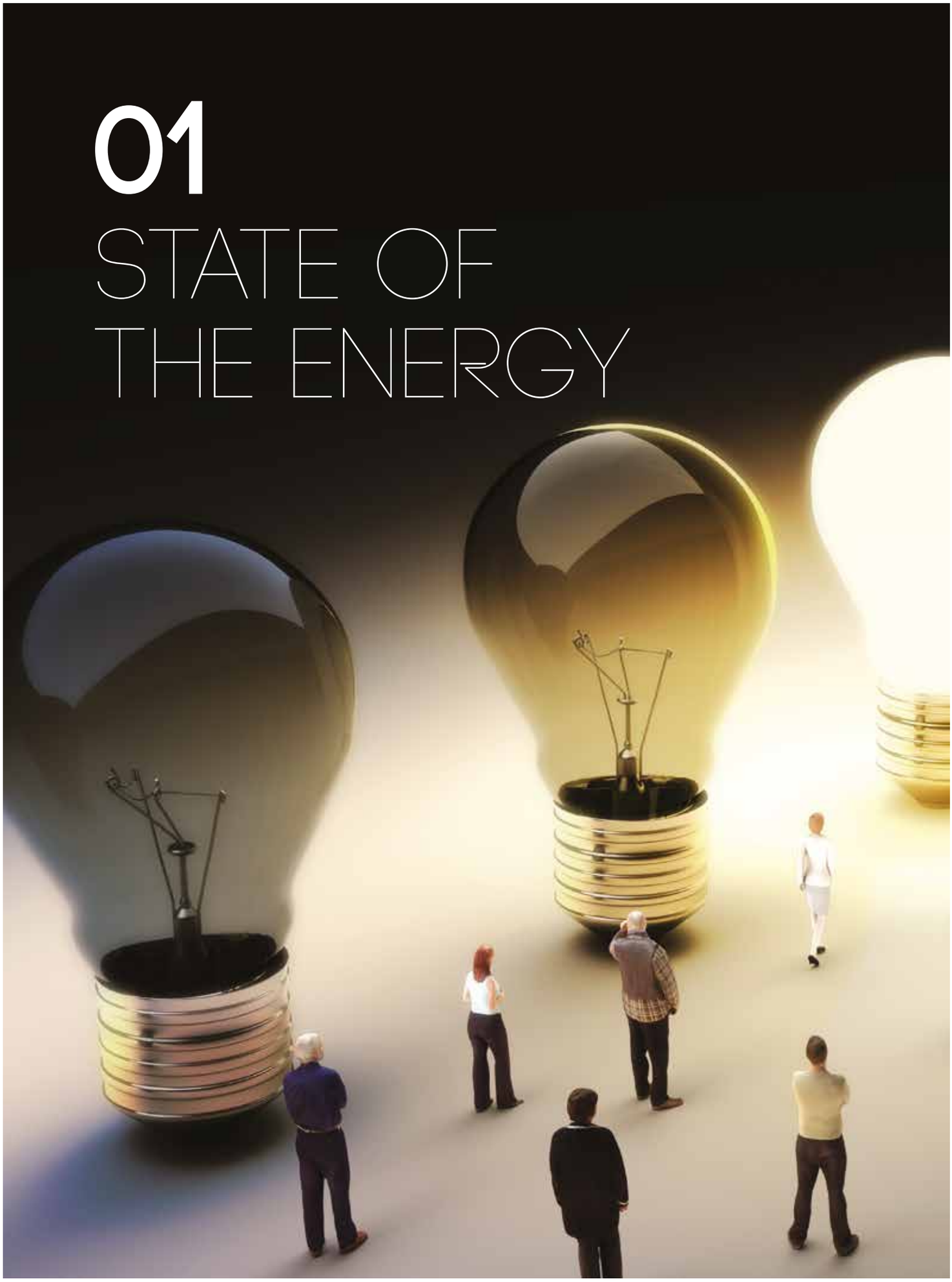
01
STATE OF THE ENERGY

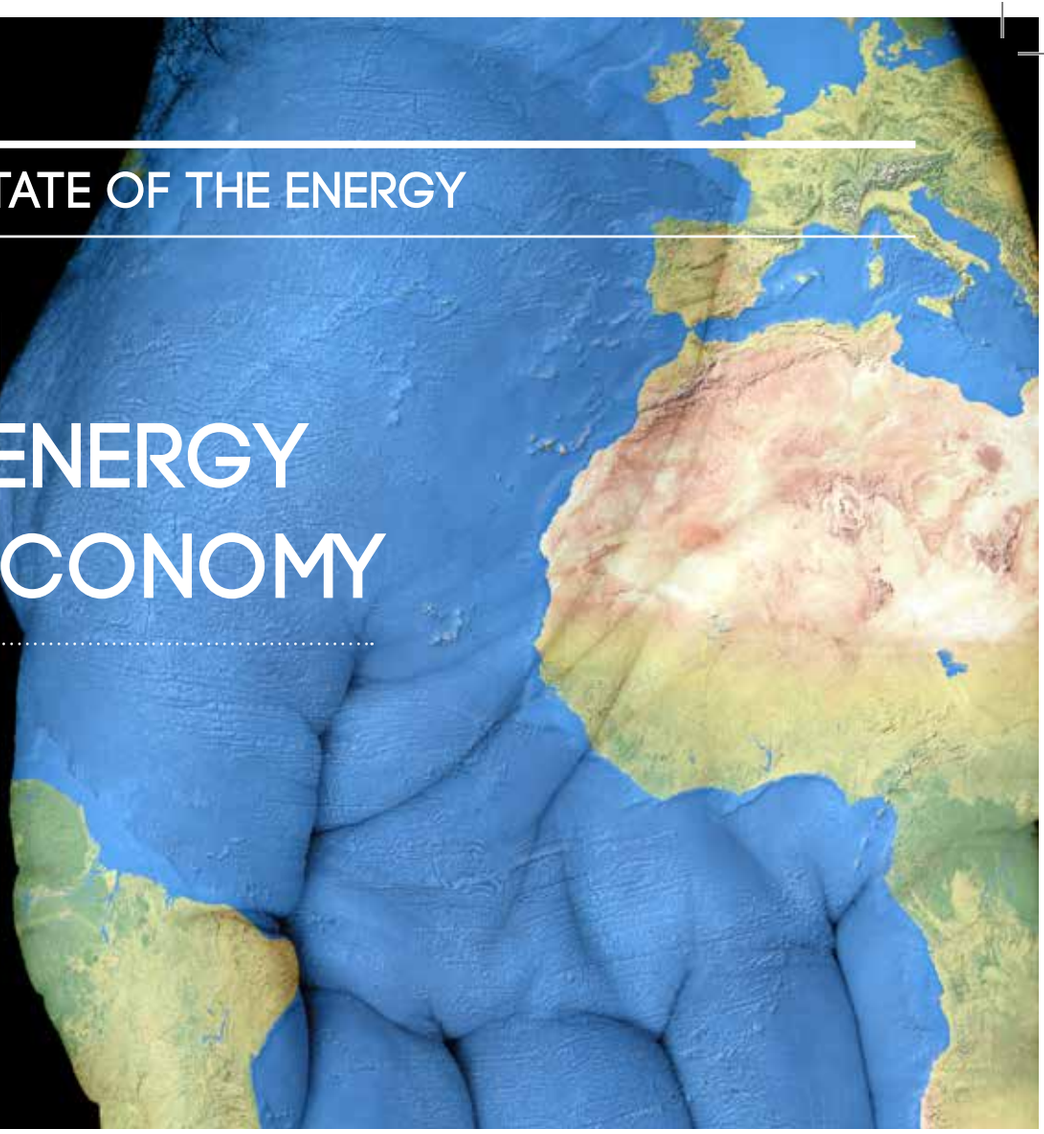


In line with the initiative 'Green Economy for Sustainable Development' of HH Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of UAE and Ruler of Dubai and following the Dubai government strategy to reduce global warming and implement sustainable solutions to energy production and consumption, the green economy framework is widely recognised as crucial in transforming Dubai into a sustainable energy hub. This will be accomplished through the efficient management of energy consumption and the promotion of renewable energy sources. Delving into emission reduction initiatives and through Dubai's 'Integrated Energy Strategy for 2030', the environmental and economic implications of reducing energy consumption are progressively becoming relevant to the Emirate. In my role as Secretary General of Dubai Supreme Council of Energy, I am pleased to present to you an overview on the current state of Dubai's energy industry from a holistic perspective, the trends and regulatory frameworks and synergies with the Emirate's vision for a green economy for sustainable development".

HE AHMED AL MUHAIRBI

SECRETARY GENERAL,
DUBAI SUPREME COUNCIL
OF ENERGY

CHAPTER 1
STATE OF ENERGY & GREEN ECONOMY



By Kishan Khoday,
Regional Practice Leader
for Energy & Environment
UNDP Regional Centre in Cairo

By Marwan Owaygen,
Regional Climate Change
Policy Advisor
UNDP Regional Centre in Cairo

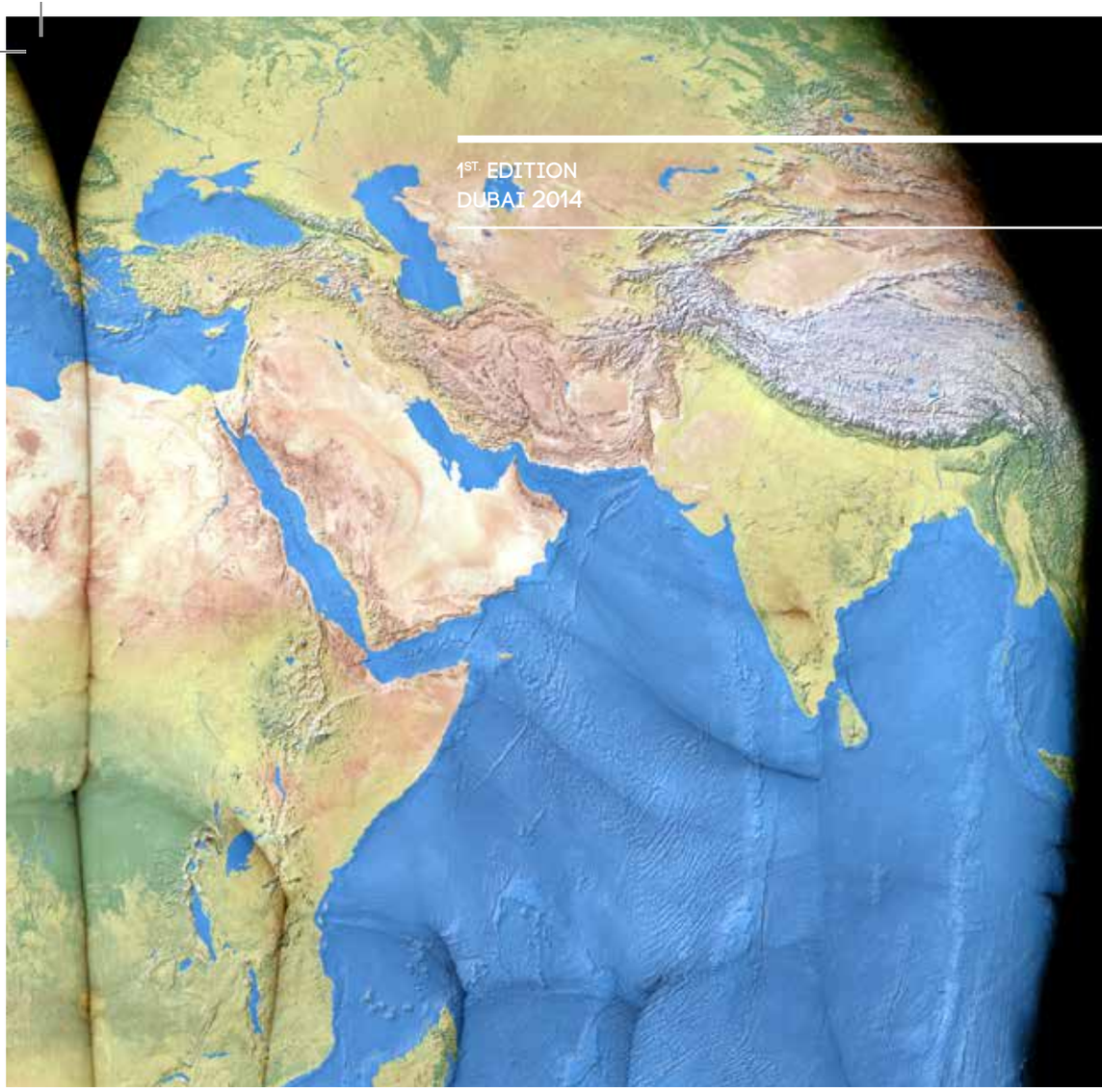
THE STATE OF DUBAI'S ENERGY AND ITS PATH TO GREEN ECONOMY

In 2012, the United Nations Conference on Sustainable Development (Rio+20) called for urgent action to put our world on a more sustainable path of development. Representatives from government, private sector and civil society organisations came together and agreed that today's systems of economic growth are pushing our planet to the brink of its natural boundaries. In an effort to achieve the goal of sustainable development, the green economy concept has arisen in recent years as a means to this goal.

As noted by the UN, "the green economy can be defined as one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities". The green economy concept has arisen as a way forward, as a means of turning the crisis of resource insecurity and ecological change into an opportunity for new solutions - driven by policy innovation, market-based mechanisms and new markets for clean technology. Rather than new green measures being a burden on the economy, or creating new risks to growth, green investment can help boost growth while at the same time reducing vulnerability to risk. With the Arab region facing the world's highest levels of food and water scarcity, green economy approaches and more sustainable use of energy in particular, can bring co-benefits for goals of human security, with the food-energy-water nexus emerging as a top priority in the Arab region.

Technology has a key role in driving the emergence of transformational changes needed for the emergence of the green economy, with the shift to more sustainable forms of energy emerging as a central element in the aspired transition to a green economy. Aligned to global efforts such as the 'Sustainable Energy for All' Initiative, recent years have also seen the rise of specific strategies and policies in countries across the South to support more sustainable systems of energy production and consumption, through - for example - more efficient use of energy and expanded use of renewable energy. Investing in sustainable forms of energy can help generate new jobs, catalyse new forms of growth, improve levels of energy security and help reduce the risk from climate change.

With the inclusion of energy in the global discussions on the post-2015 sustainable development agenda and the recent declaration by the UN General Assembly of 2014 to 2024 as the decade for 'Sustainable Energy for All', there is strong impetus for supporting locally driven energy solutions. In the Arab region some countries have established national strategies for pursuing a green economy while many more have now launched specific national policies to expand the use of sustainable energy as a means of reducing energy intensity of growth, preserving



> “ the installed capacity of renewable energy in the Arab region remains low, at about 7% of overall energy mix ”

scarce resources for future generations and doing their part in the fight against climate change. Development of new sustainable energy solutions can support the rise of new high-tech industry, as an element of a future knowledge-based economy.

Sustainable energy policies and regulations can provide positive measures and incentives. In recent years national targets for expansion of renewable energy and energy efficiency have been set in several Arab countries. They also establish new institutions and regulatory agencies, along with service providers, financial institutions and research centres engaged in policy implementation. Meanwhile, sustainable energy policies and regulatory regimes can mandate technology assessments, roadmaps, action plans and legal frameworks for foreign investment and technology transfer.

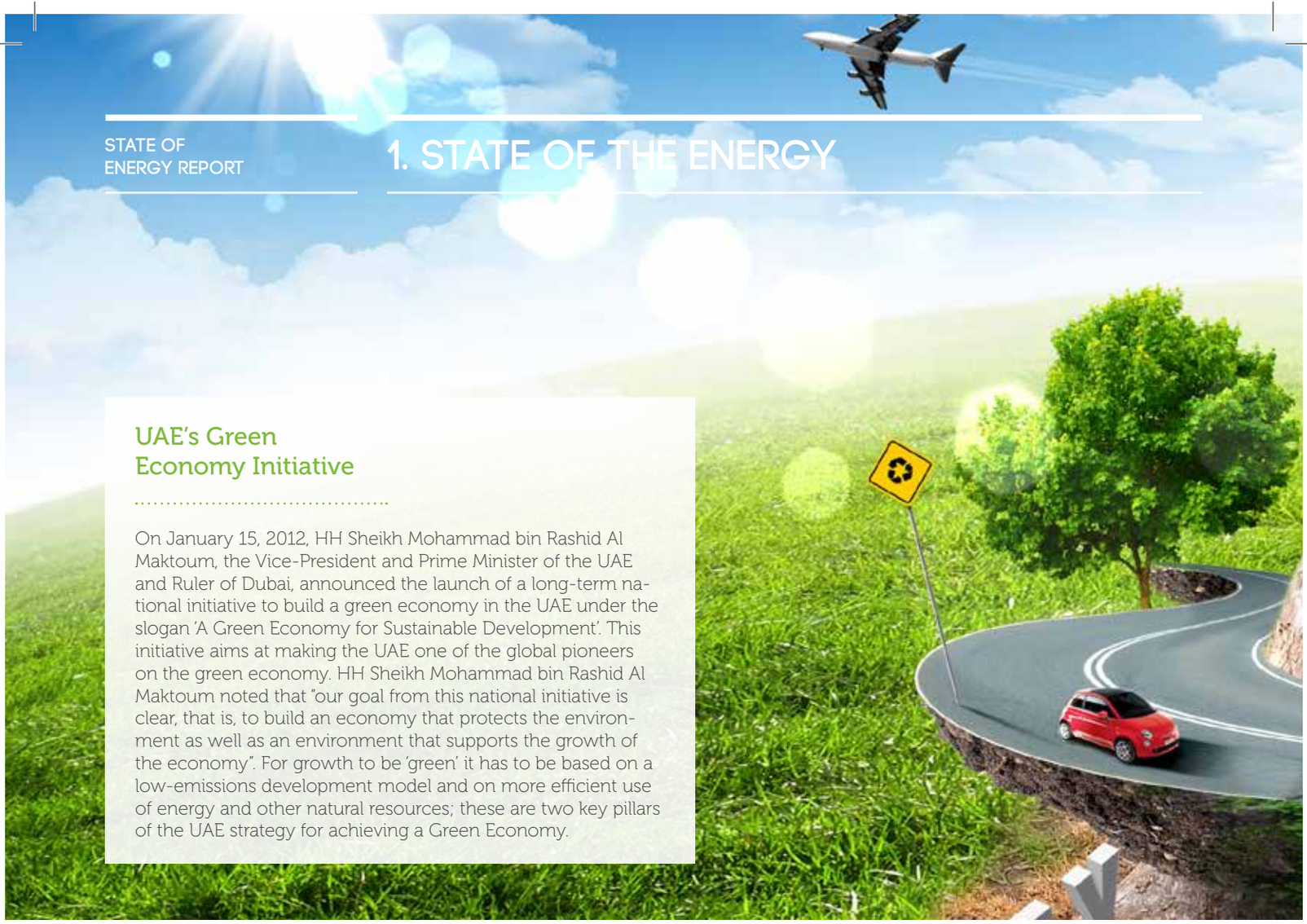
Nevertheless while emerging policies and strategies are a welcome development, the installed capacity of renewable energy in the Arab region remains low, at about 7% of overall energy mix. Thus many challenges remain in broadening the use of sustainable energy, but this is also a major opportunity. As countries shift their attention to green economy market opportunities, the sustainable energy sector in particular is one of the single largest market opportunities in coming years.

With a good foundation of national policies, attention is now placed on the establishment of public-private partnerships to engage sustainable energy opportunities and develop capacities for innovation and competitiveness to participate in a future green economy. The rapid growth in the market's interest in green initiatives and evolution of alternative and innovative finance instruments, are opening up the space for large-scale financing for a green economic transformation. The move towards sustainable energy in particular is happening on a scale, and also at a speed, never seen before, with important strides being made by emerging economies.

A particularly important factor in the rise of new sustainable energy actions has been the establishment of an enabling environment of sub-national provincial and city policies and regulations and engaging local leadership at the heart of the growth process. The rise of new sustainable energy solutions in emerging economies has been about more than increased investment and technology; and primarily has been about public policy, strategies and regulatory frameworks, including leadership at the sub-national level, to serve as market-based incentives for green economy results. If local authorities are to succeed in their efforts to support emergence of a green economy, effective partnerships with their constituencies, the national government, neighbouring countries, private sector, international development partners, the academic community and technical centres of excellence must be formed.

This inaugural **'State of Energy Report 2014'** in Dubai is a pioneering effort in this regard, showing the contribution of national and local policies, partnerships and innovation, and private investments at the base of new sustainable energy results. The lessons from UAE and Dubai provide important examples of how national and local policy-makers and private partners are converging to chart the course towards a green economy. The report shows the critical importance of fully aligning global, national and local policy-making, engaging sub-national authorities to comprehensively address the opportunities for the green economy paradigm. It also suggests that taking the necessary action to expand sustainable energy will be more effective if it helps address local development solutions, whilst achieving global and national visions for a green economy. Several key elements of this process in UAE and Dubai are elaborated further in this report.

1. STATE OF THE ENERGY



UAE's Green Economy Initiative

On January 15, 2012, HH Sheikh Mohammad bin Rashid Al Maktoum, the Vice-President and Prime Minister of the UAE and Ruler of Dubai, announced the launch of a long-term national initiative to build a green economy in the UAE under the slogan 'A Green Economy for Sustainable Development'. This initiative aims at making the UAE one of the global pioneers on the green economy. HH Sheikh Mohammad bin Rashid Al Maktoum noted that "our goal from this national initiative is clear, that is, to build an economy that protects the environment as well as an environment that supports the growth of the economy". For growth to be 'green' it has to be based on a low-emissions development model and on more efficient use of energy and other natural resources; these are two key pillars of the UAE strategy for achieving a Green Economy.

UAE Vision 2021

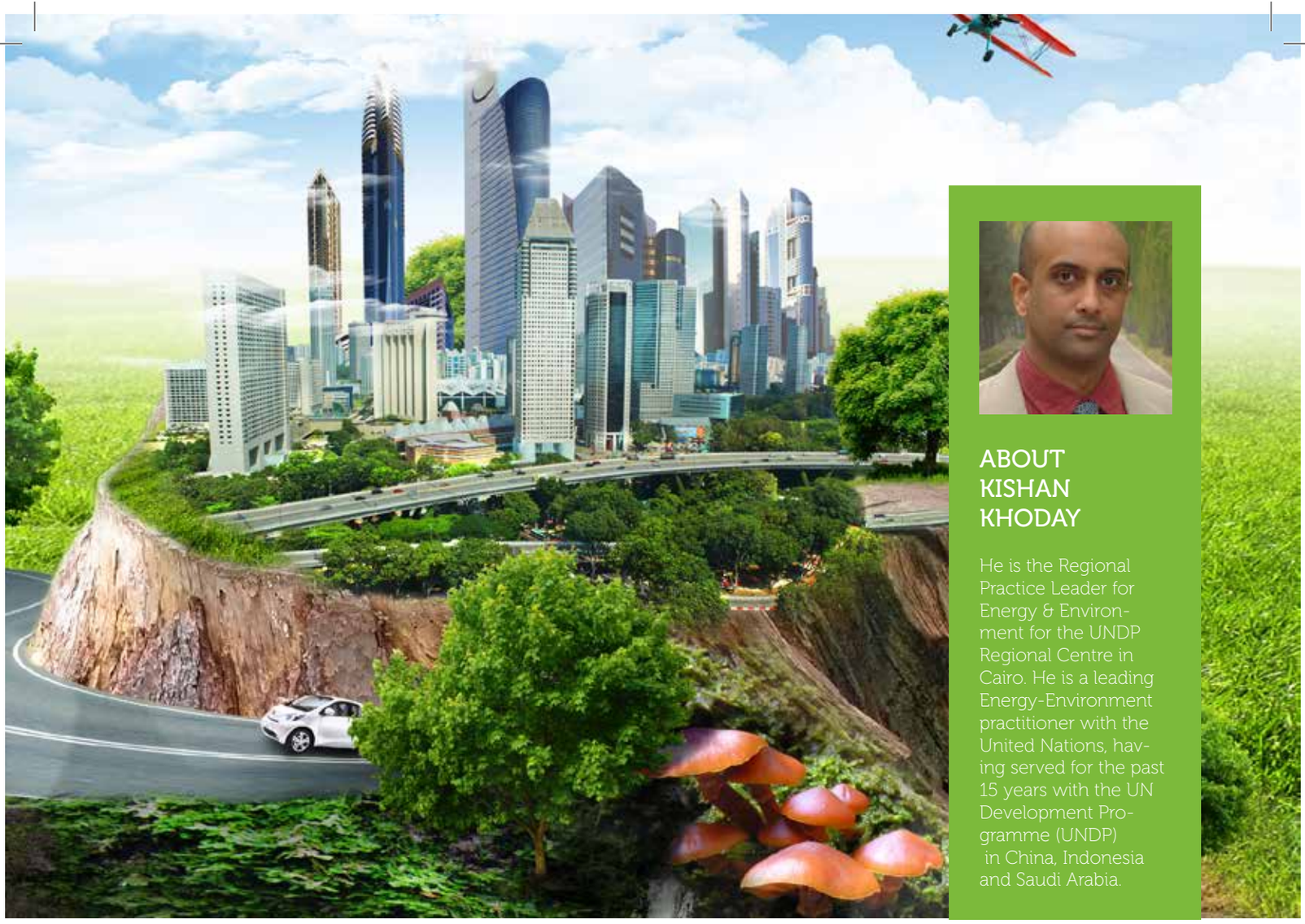
This vision specifically mentions the need to develop and promote sustainable energy as one of the key challenges facing the UAE and an important opportunity for the future. It notes that "we want the UAE to sustain its drive toward economic diversification, as this is the nation's surest path to sustainable development in a future that is less reliant on oil." In the face of climate change and its effects on current and future generations, and with the vision for an economy based on sustainable energy, UAE Vision 2021 supports initiatives to catalyse more sustainable use of energy and to be instrumental in the battle against climate change.
The UAE is committed to playing its part in developing and implementing solutions to reduce its carbon footprint while leading new innovations to achieve the goals of scaling-up sustainable energy solutions.

Dubai Strategic Plan 2015

To ensure proper focus on sustainable development in the context of Dubai's considerable economic growth, Dubai Strategic Plan 2015 aims to integrate sustainable energy solutions into energy supply and demand, to meet the Emirate's growing needs in a sustainable manner. It also highlights the concept of excellence as a core to Dubai's government policy to ensure that it leads by example on sustainable development initiatives.

Dubai Integrated Energy Strategy 2030

The Dubai Integrated Energy Strategy supports the vision of the Dubai Supreme Council of Energy to emerge as a global and regional best practice and role model in development and use of sustainable energy. According to this strategy, improving energy demand efficiency in Dubai could close the energy supply gap by up to 40% in 2030. The most substantial efficiency improvement opportunity is in the buildings, commercial and residential sector which is Dubai's largest consumer of energy. In addition to improving the overall efficiency, Dubai is also pursuing an energy supply diversification strategy. The Energy Diversification Strategy, part of the Dubai Integrated Energy Strategy 2030, has defined targets for renewable energy to supply 1% of Dubai's energy mix by 2020 and 5% by 2030. This has recently started with initial pilot solar initiatives which will serve as a base for developing large-scale solar starting in 2020, once the technology has attained cost-competitive levels.



ABOUT KISHAN KHODAY

He is the Regional Practice Leader for Energy & Environment for the UNDP Regional Centre in Cairo. He is a leading Energy-Environment practitioner with the United Nations, having served for the past 15 years with the UN Development Programme (UNDP) in China, Indonesia and Saudi Arabia.

The State of Energy Report 2014

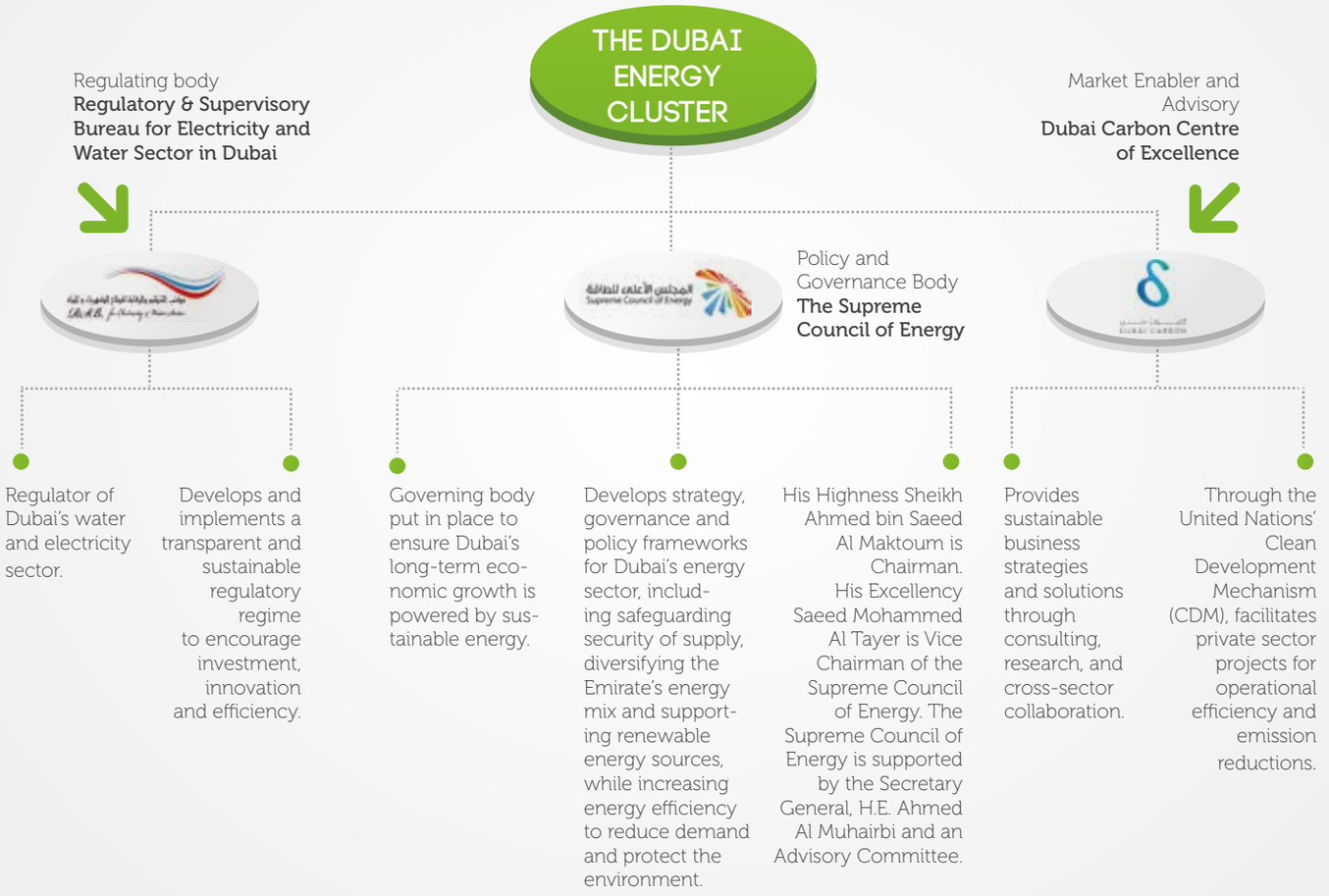
At the sub-national level, the State of Energy Report in Dubai maps the innovations and progress taking place in Dubai - and across the UAE - to pilot and scale-up energy efficiency and renewable energy measures, showing their contribution to the implementation of the UAE Green Economy Initiative, UAE Vision 2021 and the Dubai Integrated Energy Strategy 2030. This State of Energy Report 2014 showcases the contribution of local partnerships in achieving broader global and national goals of carbon footprint reduction, also in achieving the UAE vision for a green economy and implementing the country's vision for a sustainable energy future. It also presents an important baseline to measure future progress towards these goals. For investments to qualify as genuinely green economy investments, they have to be transformative with economy-wide or sector-wide impact. The report highlights sustainable energy, low carbon investments with the aim to attract business opportunities and build public-private partnerships needed to scale-up these solutions so they can become transformative and contribute to the vision for a green economy.

At the sub-regional level, the example of Dubai stands out as a sign of progress within the countries of the Gulf Cooperation Council (GCC) to expand use of renewable energy and energy efficiency in local growth patterns. It also demonstrates the effectiveness of an integrated governance model in the energy sector represented by Dubai Supreme Council of Energy, which enables fast delivery of strategic initiatives and projects. As such, the State of Energy Report 2014 in Dubai also holds potential as a model for further analysis of broader trends across the Arab Gulf. Through cooperation between the Supreme Energy Council, the Dubai Carbon Centre of Excellence, the United Nations Development Programme (UNDP) and other partner institutions, the report illustrates the value of strategic partnerships in attaining goals of green economy and sustainable energy, reaffirms UAE's commitment to global goals for a green economy and use of sustainable energy, and stands as an important source of knowledge and innovation for other countries in the Arab region and beyond.

ABOUT MARWAN OWAYGEN

He is the Regional Climate Change Policy Advisor for the UNDP Regional Centre in Cairo. Before joining UNDP, he worked for Canada International Development Research Centre (IDRC) as senior program officer and for the World Bank as expert in environmental economics. He holds a PhD in Agricultural Economics from the University of Hohenheim in Germany.

THE DUBAI ENERGY CLUSTER



THE DUBAI CFL INITIATIVE 2014

Dubai will witness its first large efficient lighting initiative in 2014. Dubai Carbon will distribute compact fluorescent lamps (CFL) along with information on energy savings in households throughout the Emirate. The awareness campaign will provide approximately 800,000 11W and 23W CFLs free of charge.

The project is registered for Certified Emission Reductions (Carbon credits) with the United Nations Framework Convention on Climate Change (UNFCCC), as the first Dubai Dubai-based project under the Clean Development Mechanism (CDM, August 2012, Ref 6316). It is expected to save over 160,000 tons of Carbon Dioxide over the duration of 7 years.

The project is fully financed by sponsors and interested entities are invited to contact Dubai Carbon for more information.

Over **150,000** households (targeted penetration)

600,000 potential recipients for your message

High density and **low density** areas of Dubai

DUBAI'S GREEN PARTNERSHIP VISION

By HE Waleed Salman

A new gateway for green trade and investment

Inspired by the Green Economy for Sustainable Development initiative announced in January 2012 by HH Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE, and Ruler of Dubai, HH Sheikh Hamdan bin Mohammed bin Rashid Al Maktoum, Crown Prince of Dubai and Chairman of the Dubai Executive Council, has launched the Dubai Green Economy Partnership to position Dubai firmly amongst the global cities that are leading their transition to green economies.

A group of committed public and private sector leaders convened to realise the vision of the Crown Prince of Dubai. Their aim was to identify how best to encourage market leadership, innovation and investment in people, in a collaborative manner. A few months later, they formed a strategy framework and a clear roadmap to guide our actions through 2015.

As the first multi-stakeholder and cross-sector partnership to promote the transition to a green and low-carbon economy in the region, our message was powerful one that resonated with global audiences in Europe and North America. Moreover, our strategic focus on global partnerships with leading organisations and markets took a boost with agreements signed with the Copenhagen Cleantech Cluster, a leading organisation representing the public and private sectors in green technology, and State of Green, the official green brand for Denmark.

As we progress, we are pursuing world-class partnerships to help build capacity through global internships and event platforms. We are also planning green-trade missions to key markets to promote green trade, investments and Dubai's vision, strategy and achievements to an influential global audience.

Closer to home, the Dubai Green Economy Partnership has entered into a strategic partnership agreement with Dubai Supreme Council of Energy, and is committed to facilitating and supporting activities that promote emerging green technologies to reduce carbon emissions, increase energy efficiency and encourage water conservation; a hallmark of the transition to a green economy.

As we grow from strength to strength - thanks to the constructive exchange of thoughts and leading practices among the members and partners Dubai Green Economy Partnership is committed to fulfilling a great vision and taking concrete steps to establish a model Public—Private Partnership. It is a significant step, especially when moving in tandem as partners; acquiring new friends as we move towards a sustainable future for all.

شراكة دبي للاقتصاد الأخضر

DUBAI GREEN ECONOMY PARTNERSHIP

Founding Members:

- Dubai Supreme Council of Energy
- Dubai Electricity and Water Authority
- Dubai Municipality
- Dubai Roads and Transport Authority
- Dubai Department of Economic Development
- Dubai FDI
- Tecom Science Cluster (Enpark/Dubiotech)
- S. S. Lootah Group
- Pacific Controls
- Dubai Carbon Centre of Excellence
- Etihad Energy Services

Chairman:
HE Waleed Salman

Secretary General:
HE Fahad Al Gergawi

ABOUT HE WALEED SALMAN

Chairman of Dubai Green Economy Partnership and Chairman of the Board of Directors of the Dubai Carbon Centre of Excellence, Waleed is advocating sustainable business practices. He is Executive Vice President of Strategy and Business Development at Dubai Electricity and Water Authority and a member of the Dubai Supreme Council of Energy of Dubai and holds over 20 years of experience in the Energy Sector.

DUBAI'S UNIQUE GOVERNANCE MODEL

By Taher Diab

Dubai Integrated Energy Strategy 2030 to drive sustainability and growth

Dubai has made a unique achievement for the Dubai Integrated Energy Strategy 2030: a governance platform that drives a unified strategy for all aspects of the energy sector to implement sustainability. Initiated by the visionary leadership of Dubai, the Dubai Supreme Council of Energy is overseeing a range of essential projects currently underway to achieve energy security and maintain sustainable growth for the Emirate.

The unprecedented growth of energy demand during Dubai's infrastructure development has increased the need to find a prudent strategy for the security of supply and the diversification of fuel sources.

A structured approach through the development of the Dubai Integrated Energy Strategy 2030 established the following fundamental elements (figure 1) that comprise a holistic approach to energy challenges:

Figure 1

Governance and Policies

This integrated strategic direction is driven by Dubai's energy key-players, who have shaped a common vision supported by a defined roadmap that will regulate the market and draw investors in clean energy technologies. Dubai is promoting the principles of Public Private Participation (PPP) and introduced laws to boost the market dynamics for partnership on a number of projects, beginning with the solar and clean coal power generation. In addition, the regulatory framework for district cooling and Energy Service Companies (ESCO) is underway to ease implementation where the efficiency of buildings can be attained. To make renewable energy more attractive, the Dubai Supreme Council of Energy and the Regulatory and Supervisory Bureau has developed the Feed-in-Tariffs and Technical Codes for Independent Solar Power Producers and seek to have them ratified by the Government of Dubai before the end of 2013.

“The unprecedented growth of energy demand during Dubai's infrastructure development has increased the need to find a prudent strategy”

Demand Side Management

Demand reduction through energy efficiency is at the top of the Supreme Council of Energy's office agenda, where the rationalised use of power and water measures has been introduced in a phased approach. The Board recently approved a Demand Side Management (DSM) implementation strategy to commence work on specific programmes and technical levers for energy efficiency and demand reduction. This has already resulted in savings achieved by introducing cost-reflective-tariffs in Dubai from 2011, and encouraging trends for reduction consumption have developed an increased awareness of conservation within the community. Another worthy measure that was introduced in 2010 is the operational synergy between Dubai Electricity and Water Authority and Dubai Aluminium, which have brought considerable savings in 2011 and 2012.

Energy Security & Economic Cost of Energy

To structure a model for a sustainable supply of energy, the Supreme Council of Energy has set a strategy of fuel-source diversification through solar and other alternative sources of energy. The launch of the Mohamed bin Rashid Al Maktoum Solar Park demonstrates Dubai's commitment to harnessing renewable energy and improving the quality of Dubai's environment, for generations to come.

As gas will remain the dominant fuel in the energy mix, specific supply and risk scenarios have been evaluated recently and linked to demand planning, market challenges and introduction of alternative sources. Dubai Municipality has initiated, as pilot project, Waste-to-Energy through recovery of bio-fuels from organic waste. Technology and economic feasibilities are being assessed for increased power generation from renewable resources and also to minimise waste-to-landfill.

Funding & Capacity Building

Dubai Integrated Energy Strategy 2030 represents the launching pad for several measures and projects targeting DSM, renewable power, energy service contractors (ESCOs), Green Building Codes, and energy-efficiency technologies. Considerable thought and analysis has gone into creating the most suitable financial mechanisms for the deployment of clean technologies in Dubai.

Integrating the objectives of building national capacity and promoting Dubai as a hub for green investment and services, the Supreme Council of Energy is developing concrete regulatory framework to attract strategic partnership and joint ventures, in addition, to government support for implementation of new projects and technologies.

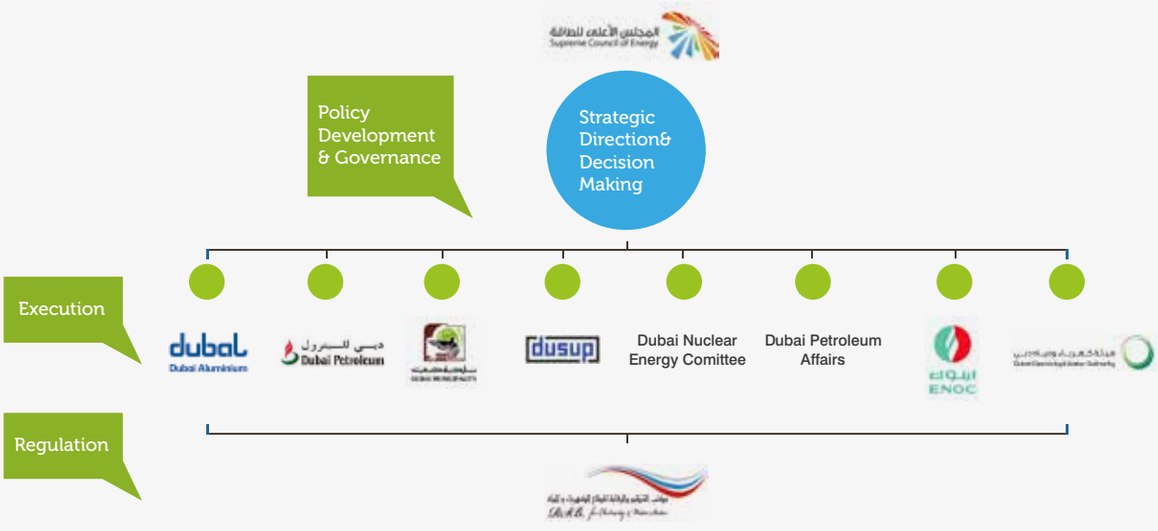
At the Supreme Council of Energy, we understand that our sustainability model is critical to the integration of energy as an essential element of our planning and economic development. This means positioning energy at the heart of our economy, while addressing environmental and social concerns. We believe that our integrated strategy and roadmap have paved the way for achieving these objectives.

ABOUT TAHER DIAB

In his current role, he is Director for Strategy and Planning for the Dubai Supreme Council of Energy. A senior expert in corporate planning, performance and quality management, he was previously engaged in the petrochemical and oil sector in the region and the US Environmental Protection Agency.

DIES 2030

Dubai's energy sector governance model



INTELLIGENT DEMAND PLANNING

By Faisal Rashid and Katarina Uherova Hasbani

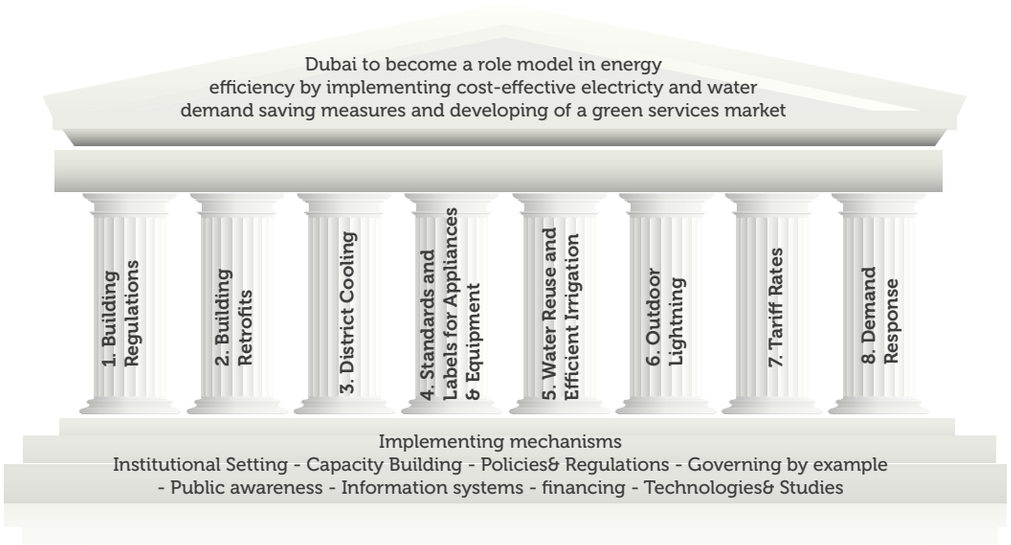
Dubai rolls out a unique Demand Side Management Plan for 2030

Increasing the efficient use of energy is a key part of Dubai's drive to increase competitiveness and sustainability of its economy. Many consider energy efficiency to be an inexpensive way to reduce energy consumption and lower greenhouse gas emissions.

This is why the reduction in Dubai's energy-demand, as compared to the business-as-usual scenario, is one of the objectives of the Dubai Integrated Energy Strategy 2030. It is also a contribution to the UAE-wide Green Economy for Sustainable Development and Green Growth initiatives. Simultaneously, the mechanism of the energy market is driving a rally in energy services that can grind down all the expected reductions in total energy use, as well as decreases in greenhouse gas emissions.

In order to achieve its target of a 30% energy demand reduction by 2030, Dubai has implemented a detailed Demand Side Management (DSM) Strategy for electricity and water, an initiative that is the first of its kind in the region. This will open up new business opportunities for sustainable and efficient business, by setting out initiatives for implementation until 2030; outlining policies, regulations, awareness schemes, technologies and finance mechanisms.

The Pillars of Dubai's Demand Side Management Strategy for 2013



FAISAL RASHID

KATARINA UHEROVA HASBANI

The strategy is based on 8 DSM programmes: Building Regulations, Building Retrofits, District Cooling, Standards and Labels for Appliances and Equipment, Water Reuse and Irrigation, Outdoor Lighting, Management of Tariffs and Demand Response. Its successful implementation will depend on the deployment of key enabling mechanisms, and the collaboration of the relevant stakeholders. These enabling mechanisms are aligned with current international best practices from similar programmes implemented worldwide. They will include institutions and capacity-building, public awareness, adequate policy and regulatory frameworks, information systems, measurement and verification and financing mechanisms, which are specifically adapted for Dubai. Furthermore, the Government of Dubai is committed to leading by example in setting high standards of energy efficiency (read more 'A Large Leap towards Energy Efficiency' in Chapter 3). Implementation of this strategy is expected to result in considerable savings: 19 terawatt hours of power and 47 billion imperial gallons of water consumption, meaning better value for Dubai customers.

An effective implementation of the DSM Roadmap requires the collaboration of key stakeholders and close cooperation between the public and private sectors in Dubai. This is why there are plans to establish a dedicated DSM agency in the close future as one of the key drivers and symbols of Dubai's commitment to its energy-efficiency goals. By providing a platform and a one-stop-shop for improved energy use, this new centre of DSM-related expertise will assist Dubai's businesses in achieving better efficiency of their operations and drive public-private partnerships. Retrofits of Dubai's existing building infrastructure were identified as an essential for improving Dubai's overall energy and water performance. As a sign of government commitment, a Super-ESCO (energy service-company) has been established to lead projects and mobilise technical expertise, finance and initial projects (read more in the interview with Etihad Energy's Hany Ayesh in Chapter 3) with retrofits planned for 30,000 buildings in the Emirate of Dubai by 2030, with an expected investment of AED 3 billion.

Dubai's DSM Strategy will continue the legacy of leadership and building a more sustainable, better future, for generations to come.

LOW CARBON STRATEGIES IN THE PUBLIC SECTOR

By Solaiman Al Rifai

As a regional first, Dubai Police has established environmental management as an important part of its operations, supplemented by their relationship with key entities.

Dubai Police has revolutionised its practices with their recent formation of a dedicated department for energy and environmental issues. This initiative comes in line with the commitment of the Dubai Police to achieve energy and environmental security for sustainable development. Dubai Carbon Centre of Excellence, as a strategic partner to Dubai Police, will provide the knowledge support and expertise required to facilitate this aim. Through energy efficiency initiatives, carbon offsets, and the use of renewable energy, Dubai Police is constantly aligning itself to the Emirate's goal for a green economy in strengthening national capacities of individuals and institutions.

The UAE aspires to become one of the most prominent countries in the world for sustainable development, by launching new initiatives; and the public sector is the first to lead this transition. The Dubai Supreme Council of Energy seeks to achieve a reduction in energy demand by 30% through demand-side initiatives by 2030, spurring Dubai Police to develop an energy policy, and initiate a strategic energy plan (ongoing since 2009). Furthermore, an internal website was launched by the Commander-in-Chief Lieutenant-General Dhahi Khalfan, and His Excellency Saeed Al Tayer, CEO and MD of Dubai Electricity and Water Authority, to strengthen and increase their efficiency.

As a result of applying best practices, Dubai Police has already reduced their energy consumption by more than 50% within a month in one of the police stations. In less than a year, one of the police stations reduced 112 tonnes of CO2; equivalent to planting 23 trees. As an overall success for the whole police force, saving 8% on their energy consumption.

With a distinct focus on operational efficiency, Dubai Police continues to explore the best means to adhere to the nation's vision for long-term social, economic and environmental prosperity.

Unique initiatives

In addition to their larger energy efficient tactics, Dubai Police has implemented:

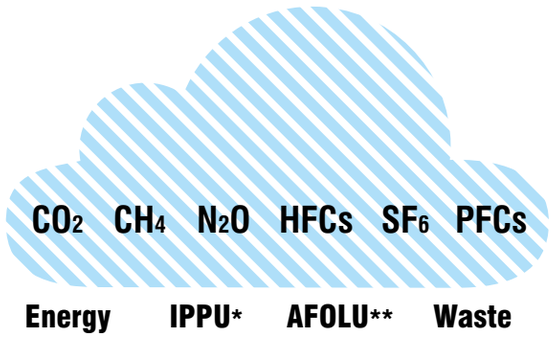
- Bio-fuel technology in one of their vehicles (pilot study).
- Electric cars for in-compound transportation.
- Solar powered speed cameras.
- Emirates Energy Star to help Dubai Police calculate their footprint from electricity use, while monitoring and controlling their buildings more efficiently.
- Applied 'Green Building' standards and codes for all their new buildings
- The Supreme Council of Energy's strategy to reduce energy consumption in existing buildings by 30%.

ABOUT SOLAIMAN AL RIFAI

He is the Director of Project Finance at Dubai Carbon where he supports the Government in the Strategy and Policy settings throughout the transition of the UAE into a Green Economy for Sustainable Development.

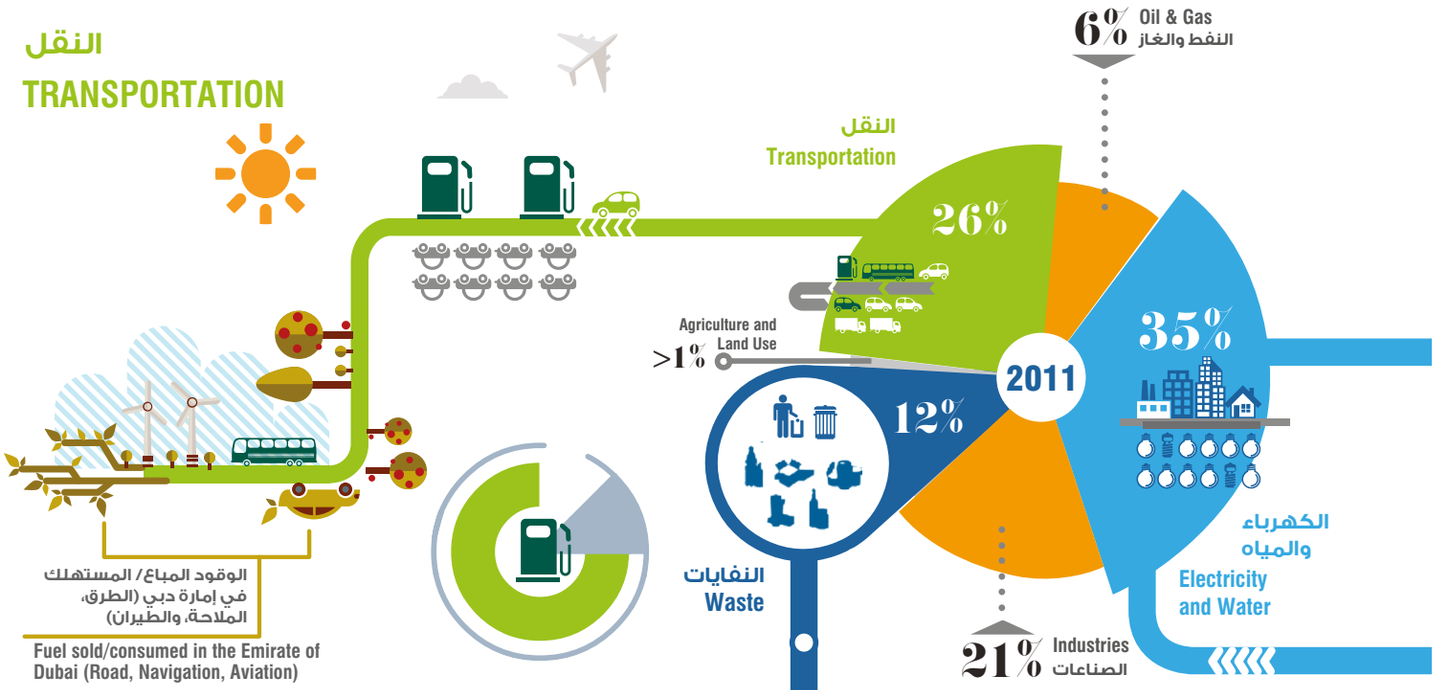
THE DUBAI GREENHOUSE GAS INVENTORY

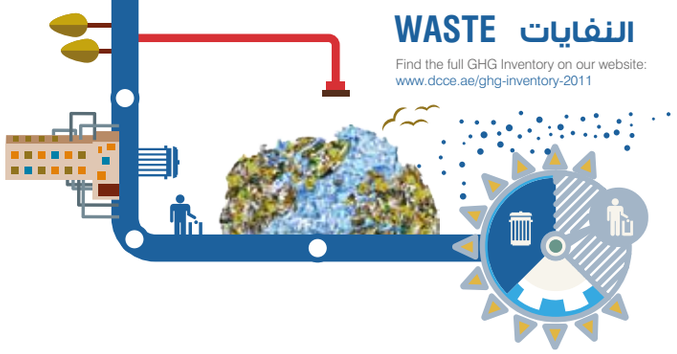
A baseline study mandated by the Dubai Supreme Council of Energy and executed by Dubai Carbon for the Emirate of Dubai 2011.



2006 IPCC* Guidelines

Example: Dubai, 2011 مثل: دبي، ٢٠١١





DID YOU KNOW?

On average a camel emits 46 kg CH_4/year

On average a cow emits 31 kg CH_4/year

هل تعلم؟

متوسط الإنبعاثات الصادرة عن الجمل هي ٤٦ كغ من الميثان في السنة

متوسط الإنبعاثات الصادرة عن البقرة هو ٣٦ كغ من الميثان في السنة

* Intergovernmental panel on climate change

A BASELINE FOR IMPROVEMENT

Addressing the Emirate's activities impact on the environment, the Dubai Supreme Council of Energy and Dubai Carbon compiled a detailed Greenhouse Gas (GHG) Inventory to document Dubai's economic growth in relation to its emissions for 2011.

Dubai's overall emissions make up 25% of the country's total, which is equivalent to 1% of that of the United States.

Emissions have been calculated across all relevant sectors: power and water, waste, transport, industries, oil and gas, agriculture, forestry, and other land use. The main sectors that were identified as contributing significantly to the Emirate's overall emissions are: electricity and water (35%), transportation (26%), industries (20%), and waste (12%).

This detailed inventory can be used as a baseline for decision-makers as it provides an accurate snapshot of the current situation. The study illustrates:

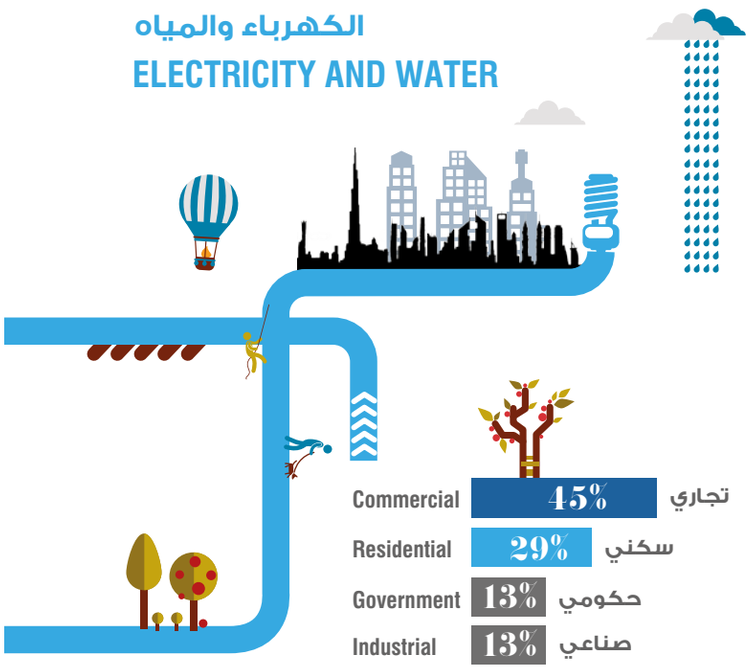
a. The share of emissions from electricity, which is in line with global averages.

b. With the global average topping 4%, emissions from waste management are uncommonly high in Dubai.

c. While the emissions from aviation meet the global benchmark of 2%, road transportation in Dubai has significantly pushed the figures up.

When compared nationally, Dubai has a positive advantage and can look into setting targets that are both internationally relevant and nationally fit. Alignment with federal objectives such as the 'UAE Vision 2021', as well as 'DIES 2030' would summon steps for reductions to be formally set, with a focus on economic viability rather than environmental compliance.

The data was collated and analysed to facilitate benchmarking and performance appraisal, in line with Law 19, and acts as an ideal launchpad for annually monitoring Dubai's performance on the emissions front. DCCE is currently collating data for a UAE-wide GHG Inventory.



حصر الغازات الدفيئة في أرقام
THE GHG INVENTORY IN NUMBERS

1557 project related emails were sent within 6 months	It took 320 work days and 11 weekends	4,274 rows worth of data were compiled into the database	741+ phone calls were made	6 versions of the final report were produced
خلال ٦ شهور تم إرسال ١٥٥٧ رسالة إلكترونية مرتبطة بالمشروع	إستغرق الأمر ٣٢٠ يوم عمل و١١ عطلة نهاية أسبوع	تم جمع البيانات في ٤٢٧٤ صف في قاعدة البيانات	تم إجراء ٧٤١ مكالمة هاتفية	تم إصدار ٦ نسخ من التقرير النهائي

* Industrial Processes & Product Use ** Agriculture Forestry & Other Land Use

21%
INDUSTRIES

35%
ELECTRICITY AND WATER

26%
TRANSPORTATION

12%
WASTE

6%
OIL AND GAS

Interview

Interview: Ahmed Al Muhairbi

Secretary General of Dubai Supreme Council of Energy

What does the Supreme Council of Energy have in store for the future?

المجلس الأعلى للطاقة
Supreme Council of Energy

This seems to be an eventful time to be heading the Supreme Council of Energy - with so much commitment to energy diversification, efficiency and sustainable use of resources from the leadership.

Ahmed Al Muhairbi: We have structured a balanced approach to achieve the sustainable growth of Dubai through the deployment of the Dubai Integrated Energy Strategy 2030 in 2011 and deliver specific initiatives and projects. A roadmap has been defined reflecting the priorities of energy supply and demand abatement measures.

The Dubai Integrated Energy Strategy 2030 is targeting diversification of fuel mix to supply energy so that power generates 5%, solar, clean coal 12%, nuclear power 12%, and natural gas 71% of the total power output for Dubai by 2030.

To date, the energy debate has largely focused on how to secure our future energy supplies and how to tap other potential sources of fuel to meet an ever-growing demand. While these aims are important, no energy policy can be complete without a comprehensive understanding of the size of the demand-abatement opportunities and how these can be captured in an economically sound way. Therefore, we have implemented a prudent strategy to reduce Dubai's energy demand by 30% over the next 20 years.

The Supreme Council of Energy was founded only four years ago. How would you define its purpose, and the role it fulfils within Dubai Government?

Ahmed Al Muhairbi: The Supreme Council of Energy was established as a governing body tasked with governance, policy development and setting strategic direction for the energy sector to deliver the following objectives: ensuring the security of Dubai's energy supply to sustain the Emirate's growth, diversification of fuel sources, streamlining the energy sector's functions in Dubai to bolster efficiency and synergy, supporting the green economy and sustainable development of the Emirate, and developing the regulatory framework required to drive implementation and attract private investment in clean energy projects.

To achieve these objectives, we have commenced with the development of the regulatory framework to influence the market dynamics and attract international investors for partnership in our Energy Projects. We support the PPP (Public-Private Partnership) model as a key catalyst to drive our projects and build capacity in Dubai.

At the same time, the establishment of the Dubai Regulatory & Supervisory Bureau (RSB) is aimed at creating the cradle to foster legislation and protect stakeholders.

Considering the diversity of their separate strategic objectives, to what extent are the member companies of the Supreme Council of Energy in agreement on subjects of strategic importance for their business?

Ahmed Al Muhairbi: Today, we feel that a robust platform championed by member companies of the Supreme Council of Energy, which include DEWA, DUBAL, ENOC, Dubai Petroleum Establishment, DUSUP, Dubai Municipality, has been established to develop several strategic measures and projects in Dubai, where energy efficiency, demand-abatement and sustainability are high on our execution agenda.

A strategic alignment was completed between the Dubai Integrated Energy Strategy 2030 and each member company, where specific projects and measures were devised to ensure their contributions. The members of the Supreme Council of Energy have contributed vastly to driving the overall strategy and we have seen evidence of this approach making a positive impact on Dubai's competiveness and growth.

Have you personally seen concrete results of the Supreme Council of Energy's initiatives yet?

Ahmed Al Muhairbi: Of course. Saving electricity and water through Demand Side Management, for example, and implemention of the new tariff price of electricity and water managed to reduce around 6% of water consumption and 2.2% of electricity consumption in 2011. We also saved around 1,508GWh of electricity per capita and 12,837 MIGD of water per capita between 2010 and 2012, after implementing the quick wins at Dubai Government organisations.

We launched the Mohammed bin Rashid Al Maktoum Solar Park, which has a planned capacity of 1000MW by 2030. The first phase will be ready by October 2013, ready to produce 13MW. A plan to follow this with a 200MW solar plant is also in the pipeline.

There have been commendable measures undertaken by the Supreme Council of Energy and government organisations to rationalise energy and enhance operational efficiencies. These have demonstrated encouraging results in the last few years in terms of production optimisation, reduction of carbon emissions and synergy.

1. STATE OF THE ENERGY

You have mandated research on the sources of Dubai's greenhouse-gas emissions. To what extent are carbon dioxide emissions affecting the strategic direction of the Supreme Council of Energy?

Ahmed Al Muhairbi: In line with the Green Economy for Sustainable Development initiative announced in 2012 by His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE, and Ruler of Dubai, we have developed a comprehensive carbon dioxide abatement strategy supported by a baseline survey for carbon dioxide emissions in Dubai. We are also in the process of developing measurement and reporting methods and carbon dioxide reduction targets for Dubai. We believe the Dubai Integrated Energy Strategy 2030 and its projects will reduce this carbon-footprint.

Can you outline the Supreme Council of Energy's focus areas over the upcoming 3 years?

Ahmed Al Muhairbi: In addition to our demand side reduction and energy efficiency projects, we have plans to further develop the solar power generation to reach 1GW by 2030, and we are on track to achieve this. We are pleased that DEWA is on track to complete the 13MW solar power project by early 2014 - the first phase of the Mohammed bin Rashid Al Maktoum Solar Park.

We are working with energy service companies to retrofit existing buildings and establish a green code for future buildings, focusing on air conditioning and lighting. We are building up the regulatory framework to attract investors. The Mohammed bin Rashid Al Maktoum Solar Park will certainly be an attractive prospect for investors in Dubai.

We have been actively engaged with local, regional and international entities representing government, industry, financing and non-government organisations. These relationships have provided a good benchmarking tool to assess where we are now and what we can take on board for the next phase. We employ a thorough evaluation of what is available in the region and globally, then adapt or devise our own plan to implement in Dubai. This fits well with our approach to promote the principle of Public-Private Partnerships.

We have a number of projects and programmes under way addressing a regulatory Framework, district-cooling, solar power, waste-to-energy, alternative transportation fuels, building efficiencies, the ESCO model, and others.

We also have a three-pronged strategy to encourage energy efficiency in terms of reducing electricity and water demand. The first is by focusing on improving the energy and water efficiencies of buildings by deploying the ESCO model and implementing the Green Building Code. The second is through our direct engagement with 33 government organisations to reduce their electricity and water use and set targets for reduction from 2014 onwards.

Our third is based on the Emirates Energy Award. We will host the first EEA award ceremony to recognise best practices in energy efficiency and energy diversification, which takes place in October 2013.

المجلس الأعلى للطاقة
Supreme Council of Energy

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ENERGY ON OUR AGENDA

By HE Razan Al Mubarak

> “(We are taking steps) to minimise the environmental impact of the energy sector.”

The way in which EAD considers the energy sector in the environmental regulatory and policy framework to avoid Greenhouse Gas emissions from multiplying with economic and population growth.

Until very recently the oil and gas sector had its own regulatory framework, meaning that the regulations and policies aimed at reducing the overall emissions of the emirates could not address the overall spectrum of emissions, and hence had only a limited impact.

This fact however changed recently and now the oil and gas sector is also included in the environmental regulatory and policy framework and a number of initiatives have already been taken.

In Abu Dhabi, undoubtedly, the energy sector is the most significant contributor to greenhouse gas emissions as well as air pollutant emissions. In 2010, Abu Dhabi's total greenhouse gas emissions were 99 million tonnes with the energy sector, including oil refining, gas processing, oil extraction and public electricity production and water desalination accounting for 72%. A similar pattern emerged for nitrogen dioxide (NO_2). Using 2010 data, Abu Dhabi's total emissions of NO_2 were 95,000 tonnes, 55,000 tonnes from oil, gas and petrochemicals and 19,000 tonnes from electricity and water.

Interest and concern regarding the emissions of greenhouse gases and air pollutants are an increasing trend; and if the economic and population growth targets for the Emirate of Abu Dhabi are met, then by 2030 the emissions of greenhouse gases, NO_2 and other emissions are forecast to more than triple unless regulatory and policy interventions are made.

To combat this growth in emissions Abu Dhabi has set ambitious goals to diversify the energy mix; to clean the fuel we use and to promote efficiency. By 2020, Abu Dhabi aims to have 30% low-carbon electricity generation capacity, including approximately 23% from nuclear and no less than 7% from renewables. Work to install the nuclear capacity is progressing as planned and with the opening of Shams 1 (the largest concentrated solar power plant in operation in the world), there is now 100-megawatt of clean energy connected to the grid.

Government entities have a target to convert 25% of their vehicles to compressed natural gas (CNG) and now ultra-low sulphur diesel is being produced in Abu Dhabi and should be available in the domestic market very soon.

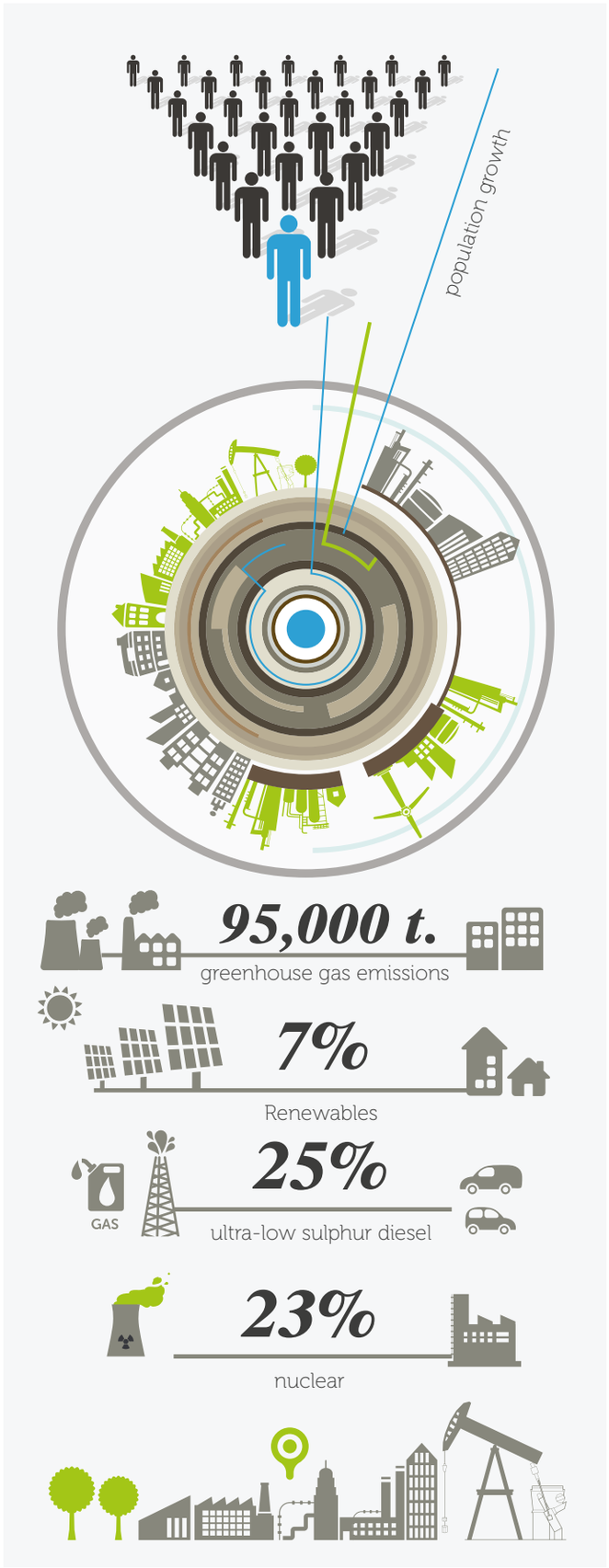
A key policy to ensure that emissions don't simply multiply in relation to economic and population growth, is resource efficiency - doing more with less. Unsurprisingly, an abundance of energy is utilised to cool indoor space; to combat this, the Executive Affairs Authority of Abu Dhabi is developing a 'Comprehensive Cooling Plan' with projected energy reductions in buildings estimated at between 30 and 48%. The technical potential for energy saving (in the best case scenario and if fully incorporated), would represent 13% of the total energy use of Abu Dhabi. This plan will also deliver economic benefits. Over a ten year period (2016-2025), the total savings (in terms of subsidy reduction) via the technically-feasible cooling potential, is projected to be AED 21.8 billion; with AED 16.4 billion accruing to the government and AED 5.4 billion to consumers (under the current tariff structure).

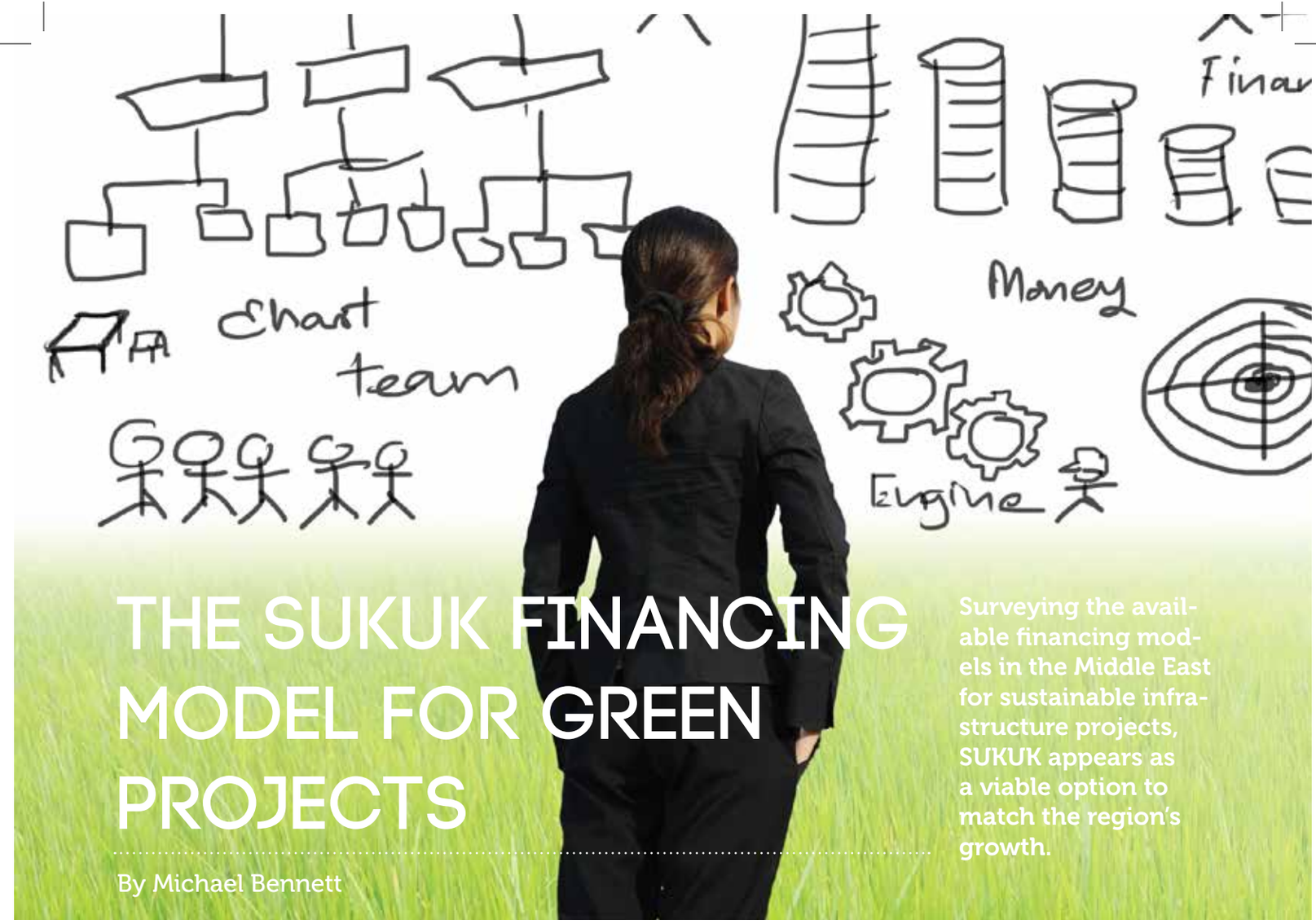
Another initiative, the Estidama Pearl Building Rating System (PBRS), encourages water, energy and waste minimisation through sustainable building design and operation, and the promotion of local material use aims to improve supply chains for sustainable and recycled materials and products. An Executive Council Order of May 2010 stated all new buildings must meet the requirements of '1 Pearl' starting from September 2010, whilst all government funded buildings must achieve a minimum '2 Pearls'.

These are a few examples of the steps being taken to minimise the environmental impact of the energy sector. As the environmental regulator in Abu Dhabi, it is necessary that we continuously enhance and strengthen our response as the economy and the population grows, but the power of individual contributions must also be considered within this context. If small steps are taken by all to save water and energy, the cumulative effect will be significant both for the environment and for the economy.

ABOUT HE RAZAN AL MUBARAK

She is Secretary-General of the Environment Agency Abu Dhabi (EAD). She leads the organisation in achieving its mandate of protecting the environment by reducing pollution and enhancing the Emirate's biodiversity. Razan is also the Managing Director of the Emirates Wildlife Society in association with the WWF (EWS-WWF) as well as the Mohamed Bin Zayed Species Conservation Fund.





THE SUKUK FINANCING MODEL FOR GREEN PROJECTS

Surveying the available financing models in the Middle East for sustainable infrastructure projects, SUKUK appears as a viable option to match the region's growth.

By Michael Bennett

Three trends are discernible in the current global financial market: (1) banks are reluctant to commit long-term capital to infrastructure finance due to stricter capital requirements; (2) an increasing number of investors are interested in 'environmentally sustainable investing' (in other words, investing to promote activities that are seen as being positive for the environment); and (3) the market for sukuk, the Islamic financial instrument most similar to a conventional bond, is growing significantly. While these three trends are distinct and not obviously related, taken together, they create a market opportunity for sukuk to be used as a tool to finance environmentally sustainable infrastructure projects.

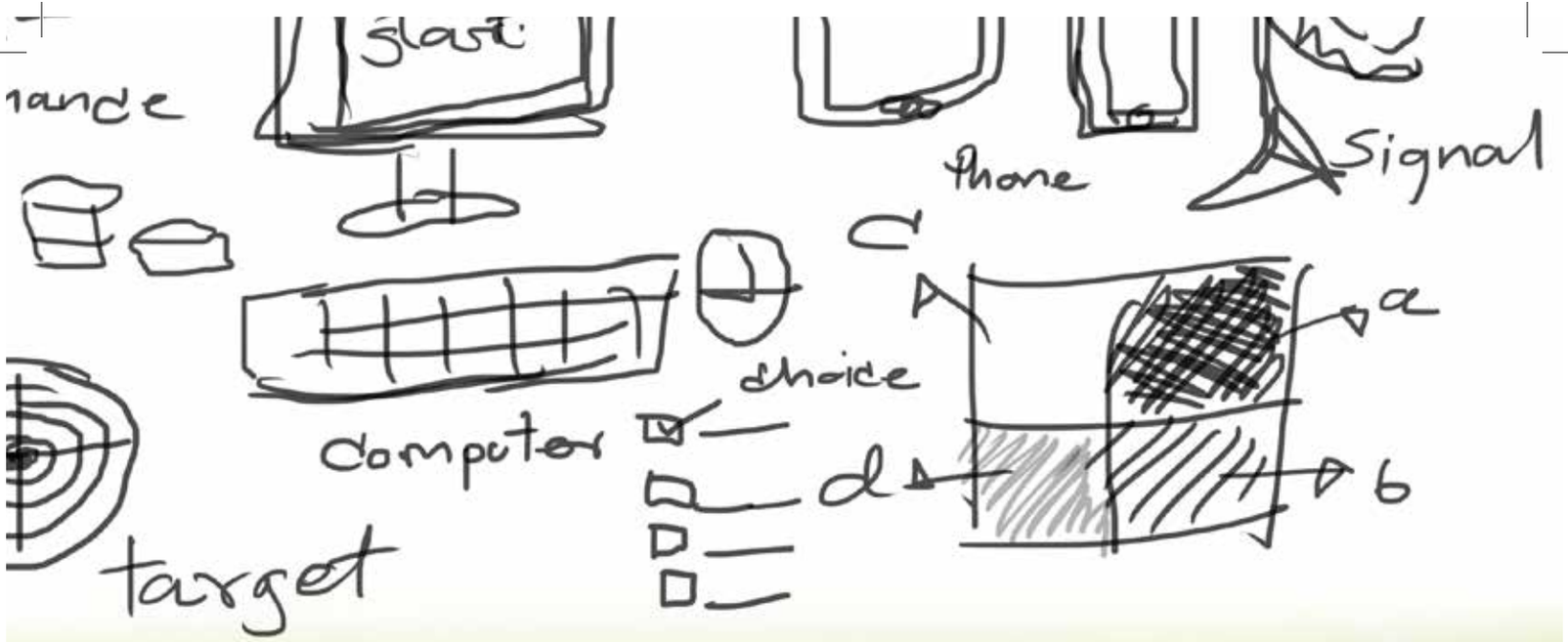
The need for significant infrastructure spending is obvious in both developed as well as developing countries. From crumbling transportation infrastructure in the United States to inadequate power generation capacity in India, the evidence is clear that improving infrastructure is a global priority. At the same time, popular concern about climate change and the detrimental impact of increasing greenhouse gas emissions has made improving infrastructure in an environmentally sensitive manner a priority also.

Banks, the traditional providers of debt finance for infrastructure projects, have been pulling back from this type of lending due to regulatory changes that have decreased bank appetites for longer dated risk. Capital markets investors are, in theory, well-placed to replace banks as the providers of debt finance for infrastructure, given that many projects offer relatively high yields with low correlation with other types of fixed income instruments. However, debt financing of infrastructure projects would be an entirely new and unfamiliar asset class for most capital markets investors. As a result, intermediaries will need to engage in considerable marketing efforts to interest capital markets investors in infrastructure, and the investments will need to be packaged in a manner that appeals to such investors.

One potential means of attracting capital markets investors interest in infrastructure finance is to combine the two other trends described above – the expanding markets for both environmentally sustainable investing and sukuk. Although, to date, these two markets have been geographically distinct - with environment-focused investors mainly found in Northern Europe, North America and Japan and sukuk investors concentrated primarily in the Persian Gulf and Malaysia – the two markets do share a strong commonality. Both environmentally sustainable investors and sukuk investors aim to use their money in a manner that conforms to their values and beliefs. Whereas traditionally, finance has been solely driven by the effort to maximise risk-adjusted returns, these types of investors have added an additional qualitative objective for financial market activity—compatibility with the investor's ethics.

A sukuk in which the proceeds are used to fund a specific environmentally sustainable infrastructure project, such as the construction of renewable energy generation facility, could appeal to both sukuk investors and conventional environment-focused investors. Combining these two distinct investor bases would be a novel development for the capital markets. While some conventional investors, mainly bank treasuries and hedge funds, purchase sukuk, the vast majority of conventional investors (including virtually all environmentally sustainable investors) have no experience at all with these instruments.

However, there is nothing intrinsic to sukuk that make them inappropriate for conventional investors. Although the structures and terminology will be unfamiliar at first, sukuk should



A sukuk is a certificate that represents the right to receive payments from an underlying asset or business venture. Unlike a conventional bond that represents an interest-bearing debt, sukuk create participation rights in assets or ventures based on various types of contracts recognised under the principles of Islamic law.

be attractive to conventional investors if they offer reasonable risk-adjusted returns and are properly marketed. A sukuk that meets those criteria and provides funding for an environmentally sustainable project could be particularly attractive to environment-focused investors for two principal reasons. First, sukuk provide investors with a high degree of certainty that their money will be used for a specific purpose. In order to comply with the underlying Shari'ah principles, the funds raised through the issue of a sukuk must be applied to investment in identifiable assets or ventures. Therefore, if a sukuk is structured to provide funds for a specified infrastructure project, such as a renewable energy project, there is little chance the investors' money will be diverted and used for another purpose.

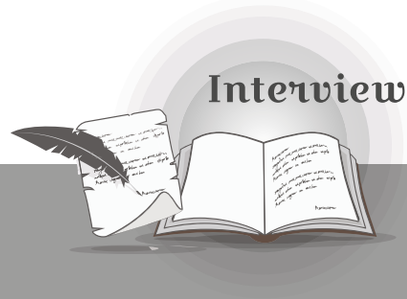
Second, many more environment-focused investment products exist on the equity side of the capital markets than on the fixed income side. The reason for this lack of supply is that the majority of corporate and sovereign bonds are general, unsecured obligations of the issuer, meaning the use of the proceeds of the bonds is not restricted to a particular purpose. Since most environmentally sustainable investors want to know precisely how their money will be used, bonds that are general obligations of an issuer have limited appeal unless all of the activities of the issuer meet the investor's environmental standards. Sukuk, which are most similar to a conventional fixed income security, could help fill the fixed income supply gap for environmental investors to the extent the proceeds of a sukuk are earmarked for a particular environmentally beneficial purpose.

In the conventional capital markets, environment-focused bonds have begun to appear in recent years. The World Bank, for example, has issued since 2008 a type of bonds called 'World Bank Green Bonds'. Rather than funding all of the activities of the World Bank, the proceeds of World Bank Green Bonds only go to support certain projects that meet predetermined criteria for low carbon development. These bonds have been very well-received by environmentally sustainable investors, and the structure has become a model for other supra-national, corporate and sub-sovereign issuers. "Green" sukuk have the potential to further broaden this market as well as to help to bridge the gap between the conventional and Islamic financial worlds.

The findings, interpretations and conclusions expressed herein are those of the author and do not necessarily reflect the views of the World Bank or its affiliated organisations.

ABOUT MICHAEL BENNETT

He is the Head of Derivatives and Structured Finance in the Treasury Department of the World Bank, which includes responsibility for the World Bank's transactional capital markets work in the area of Islamic finance. He is a graduate of Columbia University Law School in New York and has published numerous articles on financial topics including Islamic finance, structured products and derivatives regulation in Asia.



Interview: Giel-Jan Van Der Tol

What Hold's Green Projects Back?

General Manager Emirates NBD Wholesale Banking, Giel-Jan van der Tol on opportunities and challenges in the investment in green energy and why regional banks are yet to build 'renewable' specialist skills

> "Consumers eventually pay only 35% of the total theoretical market price for power"

بنك الإمارات دبي الوطني
Emirates NBD

> “ The higher cost of debt and higher cost of equity leads ... to an overall peak in project costs within the region ... by 30 to 40% relative to green projects in developed markets. ”

Within the regional context, how does Dubai fair in green investments?

Giel-Jan Van Der Tol: There's no denying that the region geographically has inherited certain advantages for solar and wind opportunities. The regional governments drive infrastructural investments that could create more demand for energy. Better value for oil could be realised from using it in relatively value-added downstream products such as pharmaceuticals. Investment in green energy could create job opportunities and widen the regional economic base. All these investments would continue to place the GCC as the preeminent energy supplier, should oil prices reverse. And of course, last but not the least; we would have done our part in meeting the global objective of reducing carbon emissions.

What is required to take green projects off the ground? Are there many challenges in establishing large-scale green projects regionally?

Giel-Jan Van Der Tol: As it stands, green energy singlehandedly cannot compete against conventional sources on price alone. This fact is compounded by regional factors, including financing issues and the need for a framework that includes all parties: financiers and inter-government representatives, both at the federal and state levels, to support each other.

The first challenge is the cost competitiveness of traditional sources in comparison to green energy. In the global arena, despite significant improvements in various technologies, capital costs incurred for green projects almost amount to roughly all costs borne from conventional sources. On top of green energy being more expensive, power is regionally significantly subsidised, to such an extent that consumers eventually pay only 35% of the total theoretical market price for power.

How does the current banking system in the region fare in supporting green projects?

Giel-Jan Van Der Tol: Although our financial system maintains a healthy liquidity base, we live in a relatively higher interest rate environment. This is a result of premiums embedded on underlying benchmarks between regional and Western markets, costs of currency swaps, and pricing for geopolitical risks for regional project finance. Typically, development banks are a major source of long-term funding at below market rates; we lack these types of institutions. And whilst the bond markets have seen a strong momentum in the past couple of years, they still remain relatively shallow compared to developed markets. Regionally, RE finance stands for 'real estate' finance or 'refinance' in the restructuring context and is seldom used in the context of 'renewable energy' finance. Regional banks are yet to build 'renewable' specialist skills on a par with global peers.

The region has also historically been accustomed to shorter debt tenors and a variable interest rate environment. Banks face severe constraints in lending long-term debt due to their own short-term funding resources; typically, banks are averse to lending beyond seven years. Also, the inability to obtain fixed rate loans could seriously affect any long-term project, especially in lower interest rate environment as ours, as any rate escalation could affect financial assumptions in long run, which in turn, makes future cash flows uncertain.

1. STATE OF THE ENERGY

> “ The governments could play a more active role in terms of investment through various sovereign support schemes or take equity stakes through a green fund. ”

What are some of the factors affecting investor confidence?

Giel-Jan Van Der Tol: The higher cost of debt and higher cost of equity leads to higher cost of capital, which leads to an overall peak in project costs within the region increasing by 30 to 40% relative to green projects in developed markets.

Regional investors are used to higher ‘expected’ returns even if not actual returns. All these factors lead to a higher cost of debt, which by its very nature, imply a higher return expectation by regional equity investors. Those that have invested in project finance prefer some government guarantee off-take, or sponsorship by some governmental body. Regional private capital also chases investment opportunities with high return expectations, whereas equity returns from project finance are typically, at best, in the low-teens. There are also geopolitical risks such as the Arab Spring, which international investors take into consideration as a blanket expectation for the wider MENA despite asymmetric risk profiles. As a result, we see a higher cost of equity.

In short, less competitive cost structure of green projects, aggravated by higher regional cost of capital, result in higher project costs, and higher break-even, and therefore, poor investor returns.

The United Nations has identified a Clean Development Mechanism that supports the infrastructure for green projects. How do we similarly overcome regional challenges with options like carbon credits which could incentivise investors and make green projects commercially viable?

Giel-Jan Van Der Tol: Regional authorities could offer banking institutions lower refinancing rates in order to provide the green sector with more attractive lending facilities while decoupling the sector from utilities and any caps or limits. Intergovernmental policies, such as the GCC grid for example, could expedite a framework for power trading.

Governments could also directly assist green project developers in line with their broader policy goals, or improve the framework for these projects to accelerate the credit approval process within banks. Alternatively, the governments could play a more active role in terms of investment through various sovereign support schemes or take equity stakes through a green fund, just like the GCC governmental bodies have invested in other joint proposals for various industries.

What other mechanisms could governments undertake for empowering green projects?

Giel-Jan Van Der Tol: A hydrocarbon credits mechanism provides incentives to green energy projects to make them cost competitive. This mechanism also provides incentives equivalent to negative externalities of conventional energy to make green energy at par on commercial terms. The price differential between market price and the price at which local utilities are supplied, for each megawatt of power could be given as credit to green energy projects.

Additionally, governments could directly participate in green ventures, taking up to 20 to 30% equity stakes, whereby assuming a subordinated position and offering other equity investors a preferred return of say 8%, before a sovereign catch-up limited to 5%. This is analogous to the atypical private equity LP/GP fund structure. If there can be subordinated debt, why not subordinated equity?

Or as mentioned earlier, perhaps governments could jointly sponsor a ‘green fund’ for the SOUQ economies – Saudi Arabia, Oman, UAE and Qatar. These internationally sought-after investment destinations collectively exhibit over 80% of total regional GDP, trade, and infrastructure expenditure, and could provide the added support for green project finance investment. The proposed SOUQ Green Fund could act either as an anchor investor, an aggregator for carbon credits, and/or invest in new technologies.

ALGERIA, BAHRAIN, BRUNEI DARUSSALAM, COLOMBIA, CÔTE D'IVOIRE, EGYPT, GABON, GHANA, INDONESIA, JORDAN, KUWAIT, LEBANON, LIBYA, MALAYSIA, MEXICO, MONGOLIA, MOROCCO, MYANMAR, NIGERIA, OMAN, PAPUA NEW GUINEA, PANAMA, PERU, QATAR, SENEGAL, SAUDI ARABIA, SOUTH AFRICA, THAILAND, THE PHILIPPINES, TUNISIA, TURKEY, UAE: ABU DHABI, **UAE: DUBAI**, UAE: RAS AL KHAIMAH

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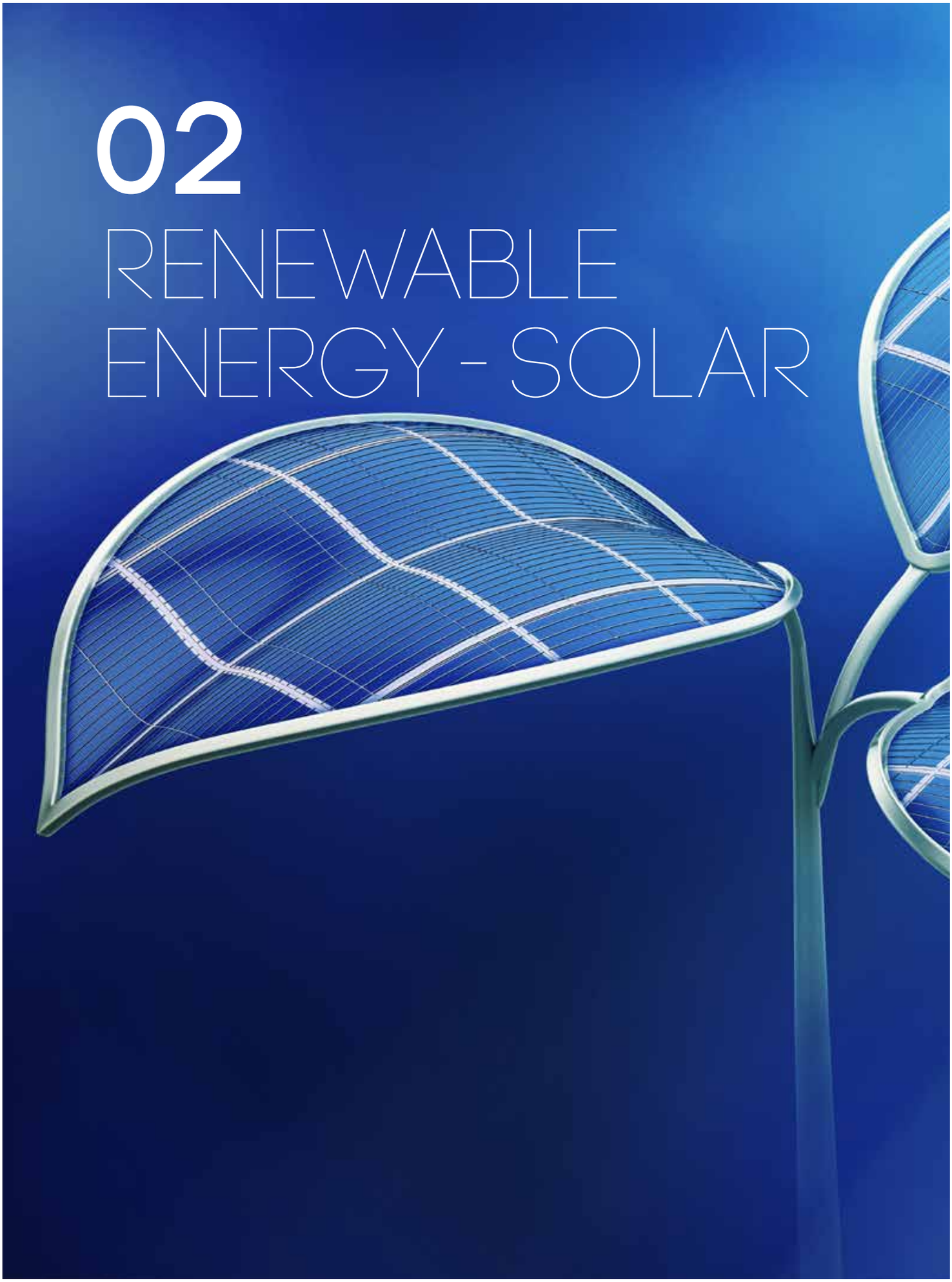
02
RENEWABLE ENERGY - SOLAR

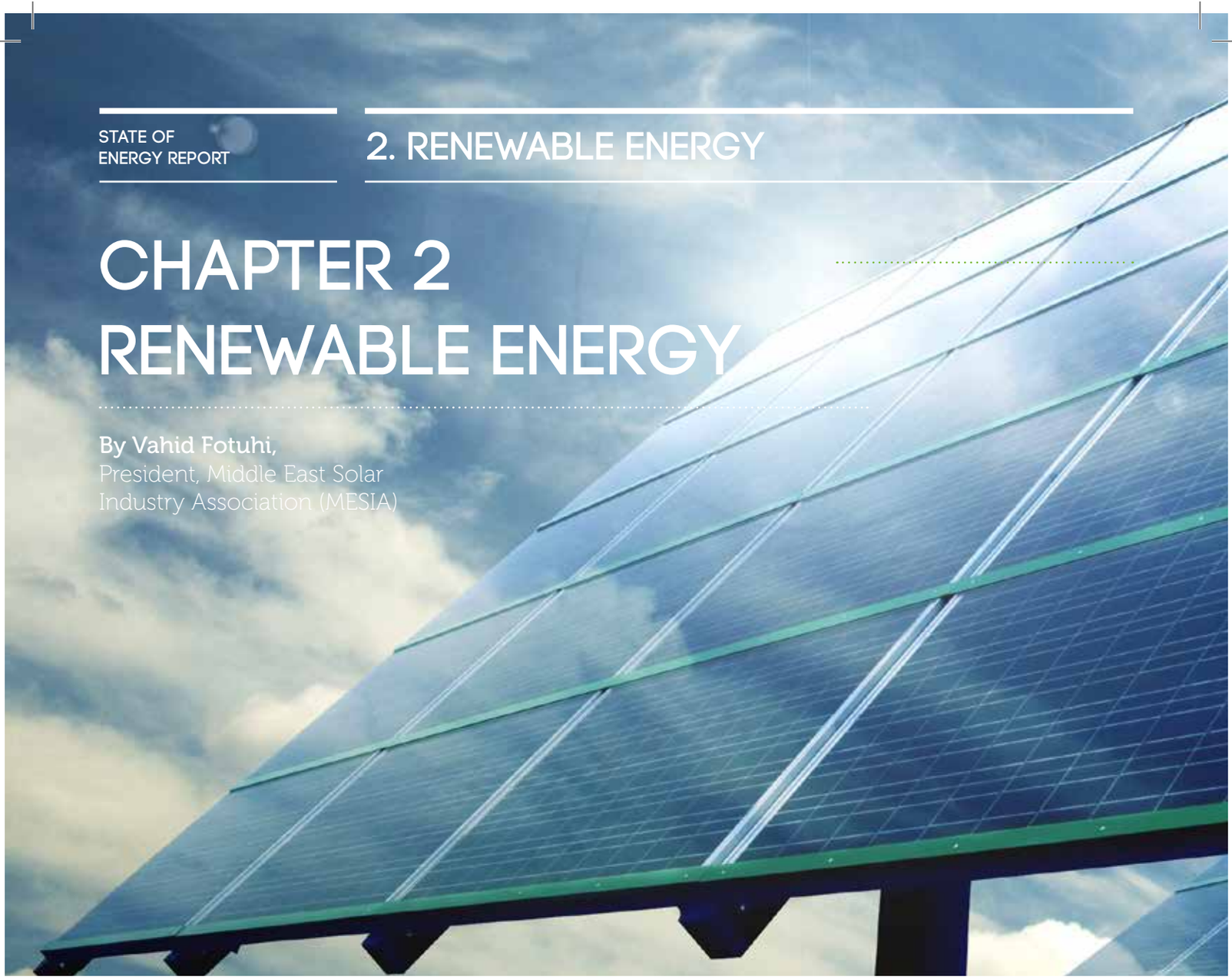


With continually high solar irradiation levels almost all year round, the region has been in the global limelight for its potential to lead the renewable energy sector in the near future. Dubai's focused effort in building its renewable energy sector has a distinct emphasis on its solar strengths, setting the stage with the Sheikh Mohammed bin Rashid Al Maktoum Solar Park (currently under development). Dubai is a role model for the creation of a new industry dimension, focusing on renewable business driven by 'green growth vision' - launched in early 2012 (the 'Green Economy for Sustainable Development') by HH Sheikh Mohammad Bin Rashid Al Maktoum Vice President, Prime Minister Of UAE and Ruler of Dubai. The programme will be based on sustainable industry development by introducing the PPP model across the whole value chain e.g. R&D, manufacturing and building local capacity and learning growth.

The Dubai Government and the Dubai Electricity and Water Authority have been examining potential incentives for private sector adoption, as well as surveying the UAE's and the region's solar initiatives as successful benchmarks. Observing the initial success stories in Dubai, we can all anticipate eventful years to come.

HE WALEED SALMAN

CHAIRMAN,
DUBAI CARBON CENTRE
OF EXCELLENCE



CHAPTER 2
RENEWABLE ENERGY

By Vahid Fotuhi,
President, Middle East Solar
Industry Association (MESIA)

Catalysts for Renewable Energy

Dubai's economy has enjoyed one of the fastest growth rates in the world over the past ten years. One of the implications of this rapid growth has been a rise in energy consumption. Indeed, Dubai's electricity demand experienced a Compound Annual Growth Rate (CAGR) of more than 8% over the past 6 years. Official forecasts estimate that electricity demand will continue to grow at between 5% and 6% over the next 10 years. This has presented Dubai with a unique predicament.

Dubai's electricity production relies heavily on natural gas. Yet, Dubai does not have any gas reserves. As such, Dubai imports its fuel for electricity generation. Most of these imports are drawn from Qatar via the Dophin pipeline under a long-term structure.

Dubai has also started the import of LNG as early as 2010. This separate fuel supply is meant to augment the capacity in the summer month as well as identify suitable feed lines to support other industries and transportation.

The importation of fuels such as LNG and potentially coal from international markets carries significant costs and energy security considerations. Amongst other considerations including sustainable development and energy diversification, this has compelled government policy makers to rationalize the demand side of the energy strategy. For example, a 'slab system' was introduced in 2011 which has incentivized consumers to be more efficient with their power demand.

There are also important environmental considerations. The UAE always ranked high in the per-capita. Although the UAE is overall a very small emitter when compared to other developed and developing countries, in 2007 the Ministry of Environment and Water launched the numerous initiatives. This made the UAE the third country in the world, after Japan and Switzerland, to embark on such in-depth research to understand and manage its long-term energy balance. These economic, energy security and environmental drivers have prompted the policy makers to look at how the supply side of Dubai's energy mix could be optimized. This led to a landmark announcement in January 2011: The Dubai Integrated Energy Strategy 2030.

Renewable Energy Policy

Under the visionary guidance of HH Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, the Dubai Integrated Energy Strategy 2030 (DIES) was established in 2011 to set the strategic direction of Dubai towards securing sustainable supply of energy and to enhance demand efficiency of water, power and fuel.

The DIES calls for cutting dependence on natural gas by increasing production of electricity from sources like clean coal, nuclear and solar and dramatically increasing energy efficiency efforts.

What this means is that alongside conventional systems, Dubai will gradually start introducing renewable energy forms of electricity. This push into renewable energy is driven by 3 factors: economic development, carbon footprint reduction and energy security.

A lack of wind and hydro resources mean that the majority of that supply is likely to be sourced from solar. Solar will help to mitigate the projected increases in electricity demand, and will help Dubai to reduce its dependence on costly imported fuels.

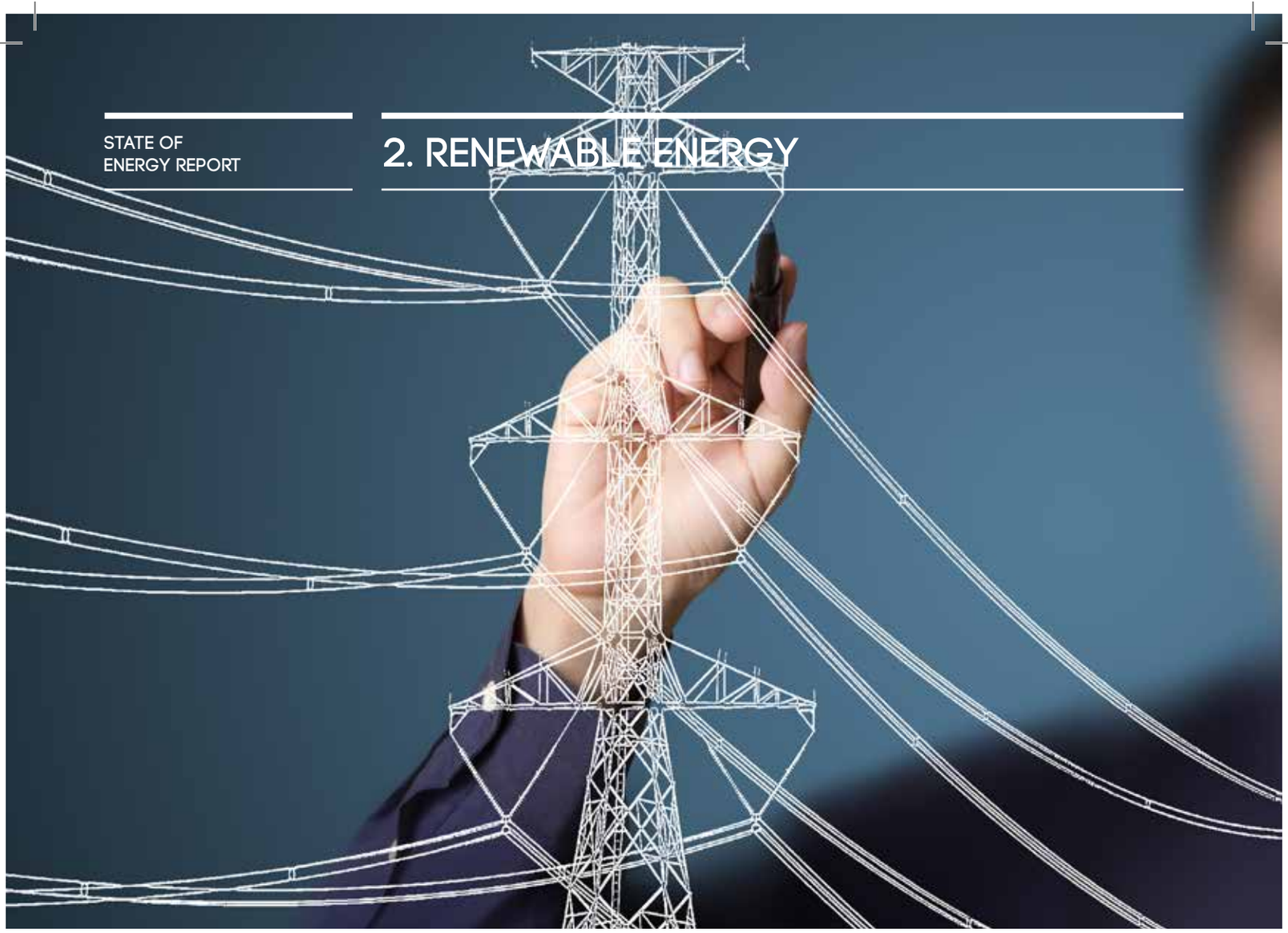
Targets

Dubai plans to supply 1% of its electricity from renewable sources by 2020 and by 2030 that percentage will grow to 5%. This will mean that by 2020 Dubai will need approximately 200 MW solar capacity installed and 1,000MW installed by 2030.

All the solar capacity will be installed in one vast 48km2 plot entitled the Sheikh Mohammed bin Rashid Al Maktoum Solar Park. This initiative was unveiled to the public in January 2012, much to the satisfaction of the renewable energy champions from around the world.
The initial phase of the Sheikh Mohammed bin Rashid Al Maktoum Solar Park consists of a 13MW plant. DEWA submitted an RFQ for the project in April 2012 and subsequently received 160 expressions of interest. This group was narrowed down to twelve qualified bidders who submitted their RFP in June 2012. In October of that year, DEWA announced that First Solar was the winner of the $33.7 million project. The project is expected to produce roughly 25,000 MWh annually once it is commissioned in October 2013. All of the electricity generated will be fed into the DEWA grid.

Future solar generating capacity needs will be forecasted by DEWA, and competitive bidding processes, primarily determined based on price, will be administered by DEWA and its partners.

2. RENEWABLE ENERGY



Rooftop **solar** market

In addition to the Sheikh Mohammed Bin Rashid Al Maktoum Solar Park, DEWA will establish a market for residential and commercial roof-top solar systems. A feed-in-tariff (FiT) mechanism is expected to be introduced in 2014 which will give rise to the emirate's solar rooftop market.

Dubai's electricity rates are at a level where residential and commercial solar can be cost-competitive with proper financing. This is in line with DEWA's goal of spurring private sector rooftop solar development and its intent to develop appropriate feed-in policy and laws. The total size of the market has not yet been defined.

Solar potential

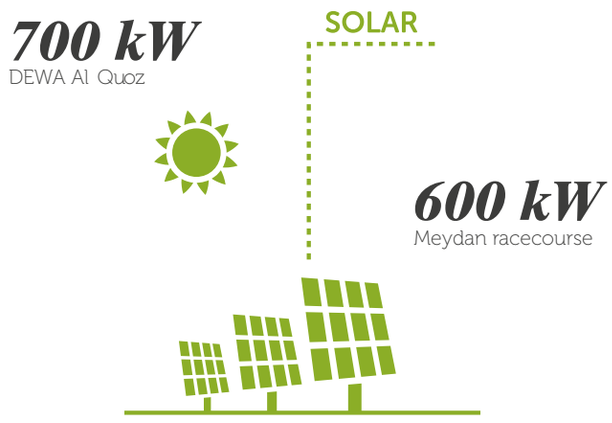
The UAE, like many nations in the Gulf region, enjoys excellent solar insolation. On average the country receives 10 sunlight hours per day. Plus the UAE receives a significant amount of solar radiation during the whole year. The UAE enjoys roughly 350 sunny days per year, making it one of the countries in the world with the highest number of sunlight hours. The total solar radiation the UAE received is nearly 6.5 kWh/m2/day and the direct normal solar radiation is 6 kWh/m2/day. The amount of solar radiation is the best indicator of the solar energy resource.

Therefore, it is expected that many installations of solar technologies will be carried out in Dubai either as deployment, demonstration, or as industrial projects in the years ahead.

Existing solar assets

As of June 2013, the cumulative installed solar capacity in Dubai was roughly 4 megawatts. The majority of this capacity comes from small residential and commercial facilities for 'green building' (LEED) certification purposes. Some of the largest systems are the 700kW DEWA Al Quoz facility and the 600 kW Meydan racecourse.

Dubai's installed capacity will more than triple due to the commissioning of the Phase 1 plant at the Sheikh Mohammad Bin Rashid Al Maktoum Solar Park in October 2013. It is expected to triple again, or more, with the unveiling of Phase 2.



Local market

Dubai has always served as a dynamic market for innovative solutions providers, including those in the solar market. In fact, even before the announcement of the Sheikh Mohammad Bin Rashid Al Maktoum Solar Park in January 2012, the majority of the solar companies in the Middle East were based in Dubai.

According to a 2009 survey conducted by the Emirates Solar Industry Association (ESIA), it found that of the 70 solar-related companies scattered across the Middle East, more than 50% of them were based in Dubai. At present, of the 120 companies that are members of ESIA; the largest number of them are based in Dubai. This confirms Dubai's status as a regional hub for solar companies and investors from around the world.

The ongoing development of a strong local solar industry will help Dubai and the UAE to develop its technological capacities. It will also help foster high value jobs to meet the need of the rapidly growing local population. At the same time, the roll-out of solar projects as part of the 5% target over the next 20 years will provide these local businesses with sustained commercial opportunities. For these reasons it is fair to assume that Dubai is taking a long term approach to solar energy, and views it as a sound economic development strategy; more than just an electricity generation solution.

Technology

In Dubai, solar energy could be generated through many different applications. Whilst the most commonly known technology is solar photovoltaic, there are many other applications such as solar thermal, also known as concentrated solar power (CSP). Even within photovoltaic applications, there are several different streams.

Currently, the government of Dubai has not set any projections in relation to the technology it will adopt in developing the subsequent phases of the Sheikh Mohammad Bin Rashid Al Maktoum Solar Park. Rather, it will continue to gage the market and work with industry partners to understand what are the leading solutions in terms of supplying reliable, bankable and long-term solar energy.

The first phase of the Sheikh Mohammad Bin Rashid Al Maktoum Solar Park consists of a technology known as 'thin film' cadmium telluride photovoltaic modules, manufactured by First Solar, the global leader in this sector. These modules consist of thin frameless glass modules which directly convert the sun's rays into solar energy.

Future phases of the solar park might use the same technology or could end up with something very different. In the long term, for example, if the costs of CSP continue to decrease, the benefits of being able to draw on electricity when there is no sun (thanks to solar storage) will likely tip the balance in favor of CSP and more of that technology will be installed.

2. RENEWABLE ENERGY

Challenges and Solutions

The path towards achieving the 1,000 MW of solar capacity will no doubt involve some obstacles along the way. Notably, there is the issue of the unique operating conditions in the deserts of Dubai. One example being that the foundation is very rocky, which makes installing pole-driven solar structures more challenging. Special equipment needs to be devised and the steel structures all need to be galvanised and chemically-coated to ensure it does not rust over the 25 year lifespan of the project.

Moreover, there is the issue of keeping the modules clean. Researchers in Saudi Arabia have found that solar systems that are not cleaned for just one month can result in a drop of output of over 30-40%. This carries very serious implications in term of energy production and cost for both large scale solar power plans and residential roof-top PV systems. Prolonged sand exposure can also have damaging effects on the modules themselves.

The role of the Supreme Council of Energy is pivotal in benchmarking best practices. Frequency of cleaning but also guidelines for selecting appropriate locations will ensure project feasibility. The current solar pilot projects are meant to provide such useful data. The Sheikh Mohammed Solar Park location is a key example, as its inland location surrounded by dunes should offer a dust free setting. For residential roof-top solar installations, implementing a periodic and systematic cleaning program can be a challenge.

Luckily, none of these problems are insurmountable. In other parts of the world with similar climates we have seen solar thrive through the adoption of simple alterations. For example, there is special machinery that can be adopted to ensure the efficient and cost-effective roll-out of large-scale solar systems. As for the cleaning, we have seen Masdar adopt a unique broom with a roller at each end which sits along the edge of the solar modules and runs up and down the solar array, cleaning the modules without the need of any water. More recent innovations include solar-powered devices that sit on the rails inside the solar park and clean the modules automatically, using very little man-power and water.

When looking at all the diverse solutions that are on the market; it becomes clear that the future for solar in Dubai is looking very bright.

ABOUT VAHID FOTUHI

He is the President of the Middle East Solar Industry Association (MESIA) and the head of Strategic Advisory at Access, a Dubai-based boutique advisory firm.

MESIA جمعية الشرق الاوسط لصناعات الطاقة الشمسية
Middle East Solar Industry Association
Empowering Solar across the Middle East

MESIA is the largest solar association in the Middle East with more than 100 member organisations. MESIA's goal is to create a vibrant solar community in the Middle East. This is done by organising events, programs and reports which are relevant to the solar industry in the MENA region. They are also tuned into solar developments across the Middle East industry in order to help identify opportunities for collaboration and partnerships.

MESIA initiates pilot projects and focus groups on everything from technology to policy. Furthermore, they assist in the development of regulations intended to strengthen the local solar industry.

MESIA has over 120 local and international company and individual members. Their Strategic and Founding Members include DEWA, Dubai Supreme Council of Energy, Dubai Carbon Centre of Excellence, First Solar, Sun and Life, Sunpower, General Electric, Apricum, Enviromena, Alsa Solar Systems, Masdar Institute, Vinson & Elkins, Siemens, Chadbourne & Parke, White & Case, Schneider Electric, Panasonic.
Membership is open to all companies who are interested in playing a role in the Middle East solar industry.

For further information about joining MESIA, please contact Sarah Fitzgerald at sarah@emiratessolar.org or visit the website **www.emiratessolar.org.**

THE SUN RISES ON DUBAI

By Fatma Al Shamsi

The Mohammed bin Rashid Al Maktoum Solar Park in the outskirts of Dubai is the first large-scale solar project for the Emirate. The plan is flexible and will follow technology developments in the upcoming years to define how the master plan will take shape.

Currently, most of Dubai's power generation is based on the combustion of imported natural gas, but the diversification of the energy mix and the reduction of greenhouse gas emissions has become two of the UAE's highest priorities.

From an economic perspective, solar energy is becoming increasingly viable, especially in parts of the world with high levels of solar irradiation, such as Dubai. The fall in photovoltaic (PV) panel prices, coupled with growing prices for conventional fuels, makes solar energy an attractive option when choosing other sources of energy that emit less greenhouse gases and save the costs of gas imports.

Accordingly, the Dubai Electricity and Water Authority (DEWA) commissioned an ambitious project: the Mohammed bin Rashid Al Maktoum Solar Park, which is planned to generate 1,000MW by 2030. As a first step towards developing the solar power park, and to show the government's commitment to implement renewable resources, the Dubai Supreme Council of Energy announced the joint-partnership and investment for the development of a 59-acre solar park in Seih Al Dahal. The first phase of the larger solar park project, a 13MW solar plant, was awarded for construction and commissioning and work has started, and is planned to be completed by October 2013.

> "The first phase of the plant is powered by Series 3 Black advanced thin-film PV modules from manufacturer First Solar"

2. RENEWABLE ENERGY

The overall development plan of the Mohammed bin Rashid Al Maktoum Solar Park has been developed with two options: recommended solar technologies will be reviewed every three to five years and the master plan will be amended, based on the economies of available technologies. The first phase of the plant is powered by Series 3 Black advanced thin-film PV modules from manufacturer First Solar.

The first phase includes 152,880 thin film modules that will generate 13MW in Seih Al Dahal: approximately 22 million kilowatt hours of electricity (kW/h) per year. This is enough to meet the average annual electricity needs of over 500 local homes. The plant's generated electricity will displace an average of 14,000 metric tons of carbon dioxide every year: the equivalent of removing 1,600 cars from roads every year.

The modules also provide other benefits, such as their proven efficiencies that have been certified by independent research laboratories. These translate into better diffused light performance. In other words, the panels continue to generate electricity on those rare cloudy days in Dubai as well as in humid, dusty conditions. Certified for hot weather, naturally, the panels and consequently the plant are designed to operate on even in the hottest summer months. This was an important factor that DEWA's team carefully considered along with Ahmed Nada, President of First Solar.

Additionally, by selecting PV for the first phase of the Solar Park, DEWA is able to conserve the country's most precious resource: water. PV energy uses little to no water during operations, contributing to DEWA's ongoing efforts to manage the ages-old balance between electricity and water.

An equally-important outcome of the project is the fact that as much as 50% of the cost of the plant was spent locally – ranging from the racks used to support the panels to the electrical components, including transformers, cables and switchgears, all of which were sourced from the UAE. Solar energy, therefore, is already contributing to domestic economic growth and building business for contractors and suppliers.

> "[The Solar Park] also fulfils a greater vision: one which has been built on the pillars on sustainability, economic progress and energy security."

The first phase of the Sheikh Mohammed bin Rashid Al Maktoum Solar Park, marks the onset of the provision of clean solar energy to the peoples of Dubai. It is also a catalyst for change, not just for Dubai but also for the solar industry in general. It establishes a much-needed benchmark and demonstrates that solar PV, with its price and operational efficiencies, is the right fit for the region's renewable energy needs. It also fulfils a greater vision: one which has been built on the pillars on sustainability, economic progress and energy security.

Dubai's ambition for harnessing solar power has yet to define its boundaries. Further plans have been set to include other facilities in the solar park, including a research and development centre, a solar innovation centre and renewable energy academy, and a dedicated solar testing field. Such facilities will support further developments in solar energy and contribute positively towards Dubai's vision for a sustainable future.

ABOUT FATMA AL SHAMSI

Fatma Alfoora Al Shamsi is Vice President of the Privatisation and Business Development at Dubai Electricity and Water Authority (DEWA). She leads the Mohammed Bin Rashid Al Makoum Solar Park Project, independent power and water production projects in Dubai, DEWA's private investment portfolio development and R&D related to DEWA's business development activities.

IN NUMBERS

59
area covered by the plant, in acres

22,000,000 kW/h
generated per year

500
number of average households that can be powered by the plant, per year

152,880
number of First Solar modules deployed

13
capacity of the plant in megawatts

Energy Academy

With the goal to qualify more personnel in the areas of renewable energy and energy efficiency, the Mohammed Bin Rashid Al Maktoum Solar Park Academy will support the ever growing demands for training in the renewable energy sector for the region. Adopting international suppliers of further training and knowledge-transfer in the fields of renewable energies and energy efficiency, it will offer immediate and precise training for rapid practical application and to fill part of the gap in the GCC market.

Research and Development (R&D) Centre

In accordance with Dubai's vision towards a knowledge-based economy and in the context of DEWA's strategic goals, DEWA is planning to create its R&D centre in the Mohammed bin Rashid Al Maktoum Solar Park. It will develop formal links with local and international research units, to support greater collaboration between researchers and the industrial sector to provide guidance and scientific consultation. A research laboratory will be dedicated to the actual performance of scientific solar and renewable energy research and provide the premises and equipment for interaction between researchers, entrepreneurs, students and industry.

Solar Innovation Centre

The project is considered a landmark in Dubai, with the aim to become a leading example in the region with sustainable building and with a world-class Solar Expo, Museum and Science Centre. The Centre's objectives include educating individuals on Solar Energy and creating interactive displays to take guests on an experiential journey where they learn the importance of solar and green energy. The centre will showcase solar technologies, the Solar Park, Dubai's strategies, initiatives and achievements and be used for tours, training, research & development, social events, and workshops as well as activities for children.

IS DUBAI READY FOR SOLAR LEASING?

By Timothy Paul

An examination whether a solar leasing model can take off in Dubai, considering the conductivity of solar photovoltaic technology in the desert city's year-round climate.

In the United States, solar leasing is quickly becoming the most favoured method for residential rooftop PV installations. According to a PWC research report, the past three years has seen a rapid shift in the residential market primarily as a direct result of this leasing model. In 2009, third party ownership with leases represented less than 20% of the California residential PV installation market, while in 2012 solar leasing claimed more than 70% market share. In fact, prior to 2010, there were few residential third-party ownership (TPO) vendors. SolarCity, Sunrun and Sungevity then began to pioneer the residential third-party financing model, and today solar leasing is now available in 14 US states, accounting for almost 70% of all residential installations in California, Arizona and Colorado. Silicon Valley, the innovation centre for new technologies and birthplace of solar leasing, is making residential solar easy. As Lyndon Rive, the head of SolarCity says, "People don't buy gas stations. People don't buy utilities. Why are we having them buy solar equipment? (With solar leasing) you get cheaper electricity! Full stop."

With around 3000 hours of sunshine per annum, Dubai could unlock the true potential of PV technology but would it be possible to replicate the success the US is currently seeing in solar leasing?
Bloomberg New Energy Finance attributes much of the success of solar leasing to the fact that consumers can avoid the high upfront costs of installation, transfer operating and maintenance responsibilities to the installer, and match or exceed electricity cost-savings with monthly lease payments.

Although solar leasing is growing, it has not been easy, and on the backend of the business model there are complicated risks, legalities and regulatory issues to iron out. For the leasing business model to make economic sense, the average household should enjoy greater electricity savings from generating solar electricity than their monthly leasing payment. To do so, the right set of ingredients must be in place. These include solar incentive schemes (subsidies or rebates, feed-in-tariffs, net metering etc.), appropriate solar conditions, suitable residential rooftops and an informed consumer market. In addition, cheap existing electricity prices make it less lucrative to switch to solar PV technologies.

Dubai with its growing economy, frequent housing developments and increasing electricity needs might very well consider the benefits of promoting residential roof top solar installations. In the meantime, key policy measures of feed-in-tariffs, net metering, integration into the grid and solar incentive schemes need to be examined. DEWA, solar installation companies, and housing developers can play a critical role in advancing the local solar leasing market.

ABOUT TIMOTHY PAUL

He is Head of Environment and Sustainability for West and Central Asia Region at Maersk Line. He holds a Masters degree in solar energy policies and advocate for a solar rooftop revolution.

SOLAR ON EVERY ROOF

By Graeme Sims

Dubai's utility provider, the legislator and regulator are working on a scheme to provide incentives for solar rooftop installations – a bold step, as this is discouraged under current law.

Renewables are on the march across the Gulf with targets announced in Saudi Arabia, Kuwait, Qatar, Abu Dhabi and of course, Dubai. Dubai's current energy strategy aims for 1% of electricity capacity to come from renewable sources by 2020 and a total of 5% by 2030, delivering diversity in fuel sources, reducing environmental impact and offering protection against fossil fuel price volatility.

The Mohammed Bin Rashid Al Maktoum Solar Park, with a planned capacity of 1,000MW generated from solar power, is Dubai's first major solar energy project and the first phase is already under construction. However, small scale renewables, sited at homes and businesses, also have a role to play.

Governments elsewhere, most notably in Europe, have encouraged the installation of photovoltaic panels on rooftops. Here in Dubai, we want to learn from the experience of other countries. There has been an impressive amount of deployment (more than 32,000MW in Germany alone) but concerns have been expressed regarding the cost of supporting renewables and the resultant burden on electricity consumers, as well as the challenges posed for management of the electricity grid.

So, a controlled phase-in of renewables is planned for Dubai. Taking advantage of the reduction in PV costs, triggered by the worldwide increase in renewables deployment and Dubai's sunny climate, means that the costs of meeting renewable energy targets can be better managed.

The encouragement of renewables should deliver other spin-off benefits: Dubai has the opportunity to develop employment and research opportunities off the back of a new solar industry. Also, the ability of householders and business people to generate electricity at their home or place of work can help raise awareness of energy conservation, contributing towards Dubai's energy efficiency goals.

Much preparatory work has already been carried out. The physical potential of solar energy in Dubai has been estimated and found to be enormous – it's possible that solar power can provide more than twice Dubai's current electricity consumption. This physical potential may not be practical or economic to exploit but it demonstrates that sunshine is not the restraining factor. DEWA's power grid has also been analysed for its ability to absorb distributed renewable generation together with the large-scale generation planned for the solar park. The conclusion from this analysis is that DEWA's robust network will not be a barrier to high levels of solar penetration. That leaves the economics. Here, the news is promising: the relative costs of conventional generation against solar power show that PV technology is will soon become on par; perhaps even as early as the end of this decade.

Bearing these positive factors in mind, the RSB and DEWA are now working on a framework to support renewable energy deployment that includes regulatory and institutional changes and pricing mechanisms, with the aim of ushering in a new, sunnier era in electricity supply for the Emirate.

> "DEWA's robust network will not be a barrier to high levels of solar penetration."

ABOUT GRAEME SIMS

Graeme 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.

SHAMS ONE - THE REGION'S FIRST LARGE-SCALE SOLAR PLANT

With the opening of the Shams One power plant in March this year, the UAE became host to the largest solar energy project in the Middle East and North Africa.

The plant, which is located near the town of Madinat Zayed in the Emirate of Abu Dhabi, has a capacity of 100 megawatts (MW) of power, enough to supply energy to 20,000 homes.

Abu Dhabi 'clean energy' company, Masdar, owns a 60% stake in Shams One. The plant was developed in partnership with French oil company Total, and Abengoa of Spain, which specialises in the engineering and construction of projects in the power and water sectors and has extensive experience in solar projects. The two companies share the remaining 40% stake. Built at a cost of US$600 million, the facility also holds a world record. It is the largest concentrated solar power plant currently in operation in the world.

Spread across 2.5 kilometres, the plant uses the latest in parabolic trough technology with giant curved mirrors concentrating the heat from sunlight into oil-filled pipes. The collected heat is then used to produce steam which powers a turbine and generates electricity. The plant relies on some natural gas, which helps boost its efficiency during the day and means electricity can also be produced at night.

The plant's desert location, where strong winds and dust are a main challenge, required an innovative approach. To protect the system's 258,000 mirrors, a large wall surrounding the complex was constructed. The mirrors are also cleaned automatically utilising a specially-designed system.

HOME-GROWN DECATHLETES

Out of 44 teams representing 23 countries, Team UAE successfully qualified to compete in the Solar Decathalon Europe (SDE) 2014, to be held in France. As the only team from Middle East and North Africa, Team UAE was formed by the collaboration of two UAE institutions, The British University in Dubai and Heriot-Watt University.

The aim of the competition is to design and build an affordable zero-net energy house for the UAE, which operates solely on solar power. It is to be built and commissioned in France in July 2014 (for the competition).

To address specific climate-related challenges, the team is applying the region's vernacular architecture methodologies, along with latest technologies, to produce an innovative modern housing prototype that is energy efficient, sustainable, affordable, and answers to the UAE residents' social needs. The design concept of the house is inspired by traditional courtyard housing, which is considered to be the most sustainable geometry in the region and it answers well to the traditional lifestyle in the UAE. It is designed as a single housing unit prototype which can be clustered into multiple housing configurations to form a sustainable community.

To ensure high levels of energy efficiency, a combination of two solar energy types; photovoltaic and solar thermal energy, is proposed to cover the house's energy needs. These systems can provide a net of 5,366 kWh and 1,400 kWh per annum for electricity consumption and domestic hot water use respectively. This is estimated to reduce carbon emissions by 3.7 tonnes. Moreover, to ensure interaction between the occupants and the house systems, an integrated home management system is included into the design. This is used to monitor energy consumption and control performance to optimise energy and reduce peak demand. The proposed design, with a gross floor area of approximately 57 square metres, is sensitive to the local climatic conditions, and integrates both passive and active innovative energy saving solutions. Based on the green strategies implemented in the design, the total energy use index (EUI) is reduced to 118.43kWh/m2 per year. This is one third of the EUI of conventional houses in the UAE.

CATALYSTS FOR RENEWABLE ENERGY

By Tanzeed Alam

Dubai's energy strategy sets the tone for the integration of renewable energy and yet there are more opportunities to be explored

Dubai is a globally recognised city that has undergone rapid development while also being open to innovation and use of new technologies. This has required significant amounts of energy, which Dubai needs to import from its neighbours. Dubai's relative scarcity of energy has led to it developing plans to improve energy efficiency and alternative means of supply.

In particular, Dubai's target to generate 5% of energy from renewable sources by 2030 mirrors others in the region; Abu Dhabi with 7% by 2020, Kuwait with 20% by 2032 and Saudi Arabia, the most ambitious of all, where it plans to install 54GW of solar and wind, corresponding to about a 40% target by 2032. Investment is also growing. Saudi Arabia plans to invest $109billion to support its target and Dubai will commit substantial resources to develop the Mohamed bin Rashid Al Maktoum Solar Park.

While the renewable energy target is a crucial first step, it is yet to be backed up with feed-in tariffs or similar support policies. Globally, 127 out of 138 countries with targets have support policies. Without supporting policy instruments, there is a risk that renewable energy targets will not be met and any supporting industry will not be commercially viable.

Dubai however has a crucial advantage over other countries in that it has an integrated energy strategy that combines both supply and demand side activities and aims for 30% demand reduction. Furthermore, its energy efficiency program is advancing. For example, it has introduced more cost-reflective tariffs. Achieving the 30% demand reduction target would help to generate income that could be used to provide up-front financing for renewable energy projects.

Dubai has great potential to deploy renewable energy, which would be further enhanced by taking the following steps:

1. Develop a more conducive energy pricing framework where renewable energy operates on a level playing field compared to fossil fuel based generation. If Dubai's neighbours follow suit, then this could allow a national and regional electricity market to develop where electricity can be traded across borders.

2. Exploring the options of public and private financing; for instance through the issuing of Shari'ah compliant bonds as a means of providing up-front financing for capital costs.

3. Greater national and regional collaboration on energy plans and strategies, for example a UAE and regional smart grid that allows for greater amounts of renewable energy to be generated. This would help reduce transmission and maintenance costs and also increase the potential to connect other renewable energy projects (e.g. solar-power from Saudi Arabia could be imported).

4. Increasing investment to build capacity, knowledge and research and development on renewable energy could provide competitive advantage for the economy (e.g. solar panels that demonstrate high performance in hot, cloudy and dusty conditions). By developing joint research strategies with existing bodies such as the Masdar Institute, Dubai would help to maximise synergies and develop skilled local graduates who can become renewable energy entrepreneurs in the future.

By building on its initial efforts, Dubai would also enhance the UAE's ability to engage more proactively in international climate and energy forums, and make its own contribution to global efforts to deal with climate change.

ABOUT TANZEED ALAM

He is the Policy Director for Emirates Wildlife Society - World Wild Fund for Nature (EWS-WWF). Previously, Tanzeed worked as EWS-WWF's climate change and sustainability manager and as a policy advisor on energy and climate change at the Royal Society in London.

RENEWABLE ENERGY AS THE GOLD AT THE END OF THE RAINBOW

By Hugo Lucas

> “1.8 million jobs can be created if all GCC countries implement their currently stated renewable energy goals.”

The region’s ambitious renewable energy targets will generate large savings in fossil fuels and create jobs.

The years between now and 2020 will be crucial in addressing the energy challenges facing GCC states.

While the region is generally endowed with abundant hydrocarbon resources, decision-makers are realizing that maintaining the status quo will become an increasingly difficult task as their countries’ economies continue to grow and diversify.

The region’s thirst for energy resources has been increasing steadily. In the last decade, average per capita energy consumption increased by 17 %, while total energy consumption has risen by 75 % since 2000. Population growth and the region’s continued efforts to develop, sometimes by attracting energy-intensive industries such as aluminium and steel manufacturing, mean demand for power will continue to grow.

When it comes to their per capita consumption of electricity, countries in the region score higher than the world average. Kuwait, with 18 megawatt hours (MWh) per person per year and Qatar, with 15 MWh, both have higher averages than the 13.5 MWh in the United States. With 11 MWh per person, the UAE comes third amongst the GCC states, and has an average almost twice as large as that of the European Union [1].

At more than 20 tons per capita, the UAE’s carbon footprint is more than four times larger than the world average.

To an extent, the UAE is locked into a pattern of high energy consumption because of its harsh climate - it relies on desalination to produce potable water and has large building cooling needs - and an energy-intensive hydrocarbon industry that is serving world energy demand. This is also true for the rest of the region. However, the adoption of energy efficiency measures and investments in renewable technologies hold significant promise.

All GCC countries now have renewable energy targets, including the UAE, where Abu Dhabi is aiming for a seven % share by 2020, while Dubai - for five % by 2030.

We at IRENA have repeatedly commended these steps and declared our willingness to help the UAE and the other countries in the region, implement these ambitious goals.

Our preliminary analysis indicates that if all GCC states implement their current stated goals, they will help save three billion barrels of oil equivalent from 2012 and 2030 [2], an amount equal to the energy consumption of Morocco for the same period. The measures will prevent greenhouse emissions equal to the footprint of Peru. Importantly for GCC states, as they continue to diversify their economies, the measures will also help create 1.8 million jobs from 2012 to 2030 [3].

Achieving the UAE’s ambitious targets will require strategic government planning, the creation of a supportive legislative framework and some incentives for renewable industry players. IRENA is excited at the opportunity to assist in this exciting transition that augurs well for the UAE’s environmental record and its development path.

Qatar

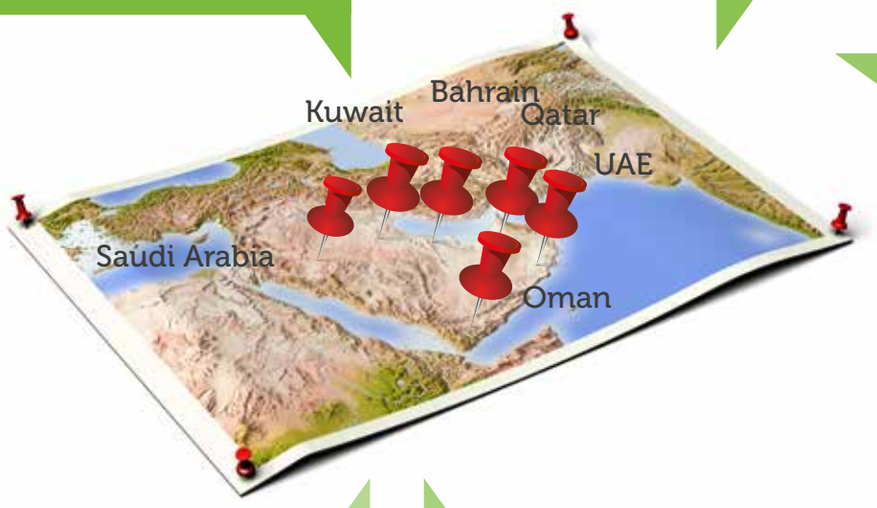
- **Solar power plant (100MW)** Planned
- **Biomass plant (40MW)** Completed

Kuwait

- **Solar Power Plant (1250MW)** Planned
- **Solar component in combined-cycle gas power plant** (60MW) Planned
- **Wind turbine** (10MW) Under construction

Bahrain

- **Concentrated solar power plant (500MW)** Planned
- **Wind energy plant** Planned
- **Two "hybrid" power plants for solar and wind energy (5MW each)** Planned
- **PV Plant** Planned



United Arab Emirates

- **Dubai solar park (10MW in 2013)**
- **2 wind energy plant (each 30MW)** Planned
- **Solar power plant (40MW)** Planned
- **Noor 1 Solar PV plant (100MW)** Planned
- **2 solar power plants** Under construction
- **Solar roof program (500MW)** Under construction
- **Floating solar island project (1MW)** Completed
- **Masdar Institute roof (1MW)** Completed
- **Solar PV park (10MW)** Completed
- **Shams 1 CSP plant** (**100MW**) Completed

Saudi Arabia

- **PV Plant Makkah (100MW**) Planned
- **Solar thermal plant (2-4MW)** Planned
- **Solar facility on parking lot (10MW)** Planned
- **Solar powered desalination plant** Under construction
- **KAUST Solar rooftop PV panels (2MW)** Completed
- **Solar field** Under construction
- **Solar park (3.5MW)** Under construction

Oman

- **CSP power project (50-200MW)** Planned
- **Solar thermal powered oil recovery plant (7MW**) Planned
- **Solar-powered desalination plant (6000 litres/hour)** Planned
- **Biofuel date palm factory (900,000 litres/day**) Planned
- **Photovoltaic demonstrator (12MW)** Completed

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ABOUT HUGO LUCAS

At present, holds the position of Director for Policy Advisory Services and Capacity Building at International Renewable Energy Agency IRENA. For more information visit www.irena.org or check the Global Atlas, a comprehensive information platform on the potential of renewable energy available on www.irena.org/globalatlas/

MAPPING THE UAE'S ENERGY SOURCES

By Taha Ouarda

UAE-based researchers develop national-level resource mapping tools to determine the most productive locations for solar and wind power plants.

With the region's irrefutable advantage in wind and solar energy sources, an energy atlas within the Arabian Gulf was launched last year at the United Nations Framework Convention on Climate Change (UNFCCC Rio+20) conference, as a way to monitor and enhance existing sites for further development. As the backbone of this project, the International Renewable Energy Agency (IRENA and the Research Centre for Renewable Energy Mapping and Assessment (ReCREMA) in Masdar Institute focus on developing knowledge and leadership in this sphere for countries with similar climates in the Gulf and Africa.

Through collaboration with local and international partners, ReCREMA is in the process of building profiles on solar and wind resource potential, land use, and grid connectivity, in addition to the development of wind speed maps corresponding to a number of heights (as different turbine technologies work at different heights), and solar radiation maps using a robust satellite-based solar mapping tool developed and validated onsite. These maps depict hourly, daily, and yearly variations of the three solar components (global, beam and diffuse)— accurate knowledge of which is essential for the economics, design and simulation of different applications within the solar industry. For instance, to determine the power generation capacity and efficiency of a solar technology, concentrating solar collectors require accurate direct normal radiation assessments, while photovoltaics require accurate assessments of all three components [i.e., direct normal and diffuse horizontal irradiance (DNI and DHI) and global horizontal irradiance (GHI)].

ReCREMA was mandated by the UAE Government to develop national-level solar and wind resource mapping tools. Eight years of global and diffuse horizontal, and direct normal irradiance profiles are generated using an in-house robust satellite-based model, every 15 minutes at 3x3 km resolution, for country-wide assessment and prospecting.

Launched officially in April 2012 during a signing ceremony attended by the centre's partners and stakeholders, ReCREMA has an illustrious panel of founding members, including the UAE Directorate of Energy and Climate Change, Dubai Supreme Council of Energy, and Environment Agency – Abu Dhabi. Separate agreements for collaboration were signed with IRENA, the UAE National Centre of Meteorology and Seismology (NCMS), Total Energy (France) and ParisTech (France).

For the past two years, the centre has been actively engaged in research in solar resource assessment, solar technologies and remote sensing fields, developing regional knowledge and leadership in renewable energy assessment and mapping in arid and dusty environments. ReCREMA is presently involved in several renewable energy resource assessment projects in Qatar, Saudi Arabia, Namibia, Seychelles and Mauritania.

On a domestic level, in addition to human capital development, a renewable energy atlas will allow data generation that is adapted to the specific conditions in the UAE and other similar climatic regions. Greater accuracy and coverage will help attract investment into the national renewable energy sector, and can underpin policy decisions on legal and financing frameworks.

Visit:
www.recrema.masdar.ac.ae

ABOUT TAHA OUARDA

Dr. Taha B.M.J. Ouarda, Professor and Head of the Institute Center for Water Advanced Technology and Environmental Research (iWATER) at Masdar Institute, is also leading the development of the UAE Wind Atlas.

DESALINATED WATER FOR WILDLIFE

By HE Razan Al Mubarak

The Environment Agency – Abu Dhabi (EAD) uses innovative solar desalination techniques to provide its protected, remote areas with fresh water.

Part of the mandate of the Environment Agency – Abu Dhabi (EAD) is to promote and enhance wildlife and habitats within protected areas. Some of the protected areas are remote, difficult to access and do not have any naturally occurring surface water. The top of the groundwater table under the protected areas is around 30 metres deep and the water is mainly saline. Any infrastructure introduced into protected areas to provide water needs to be environmentally friendly, efficient and low maintenance. Solar desalination units were identified as a good option and EAD now operates 30 units distributed within protected areas across Abu Dhabi.

Design criteria for the 30 reverse osmosis units powered by solar photovoltaic	
Feed water	Groundwater with a salinity of 35,000 ppm
Unit production capacity	4 m^3 x 6 hours = 24m^3 per day
Produced water quality	Between 500 – 1000 ppm more than suitable for livestock and irrigation
Energy source	Solar PV
Desalination Technology	Membrane – Reverse Osmosis (RO)
Photovoltaic (PV) efficiency	PV modules are approx. 18% efficient.
Recovery ratio (fresh water/brine)	Between 50 and 60%

The units can operate around the design specification; however, variability of the salinity of the groundwater means that the units require constant fine tuning and balancing. The salinity of the groundwater can spike up to 50,000 ppm which shortens the life of the membranes and requires a higher power input to keep the water production constant. This high salinity also alters the ratio of fresh water to brine production; at 50,000 ppm more brine is produced than fresh water.

The harshness of the environment in which these units are operating also presents some additional challenges. The units are located in remote areas amongst dunes and are constantly challenged from shifting sands and the dustiness of the environment; this means that the photovoltaic panels require regular cleaning and maintenance. The brine produced also needs to be removed and disposed of correctly. These challenges mean that the units require near constant supervision and have a higher maintenance footprint than was envisaged.

To summarise, the technology works, however not at the performance level given by the manufacturers, due to the harshness of the desert environment and the hyper saline concentrations of some of the locations. To overcome these challenges, EAD is relocating some of the units to less remote and more accessible locations to cut down the time and cost involved with maintenance. For other units that need to remain in remote and challenging locations, the introduction of telemetry and remote sensing is being considered to provide early warning signals if the units are malfunctioning, which should lead to a reduction of the frequency of speculative maintenance visits.

When reflecting upon the option of groundwater solar desalination in remote areas, careful consideration must be given to the operational maintenance costs, manpower and location prior to a decision being made.

ABOUT HE RAZAN AL MUBARAK

Razan is Secretary-General of the Environment Agency Abu Dhabi (EAD). She leads the organisation in achieving its mandate of protecting the environment by reducing pollution and enhancing the Emirate's biodiversity. Razan is also the Managing Director of the Emirates Wildlife Society in association with the WWF (EWS-WWF) as well as the Mohamed Bin Zayed Species Conservation Fund.

Interview

Interview: Adnan Amin

Director-General of the International Renewable Energy Agency (IRENA)

> “...the UAE has allocated US$350 million through the Abu Dhabi Fund for Development (ADFD) to innovative renewable energy projects in developing economies..”

IRENA
International Renewable Energy Agency

IRENA has been headquartered in the UAE for over four years, can you share your impressions about how the country's energy policy has changed during this time?

Adnan Amin: IRENA's presence reflects the UAE's strategic choice to shift from an oil-based economy to a broader energy economy; incorporating increasing shares of renewable energy. The intentions of the largest of the UAE's Emirates is reflected in the renewable energy targets they have adopted - Abu Dhabi is working towards 7 % by 2020 and Dubai is targeting 5 % by 2030. The UAE is a frontrunner in renewables within the region, where many countries have also recently adopted renewable energy targets and are working to improve energy efficiency. Further to this, Abu Dhabi was chosen on 30 June 2009, to host the permanent global headquarters of IRENA, and it was also in Abu Dhabi that IRENA was formally established in April 2011.

The UAE's leading role in the transition to a sustainable energy future is demonstrated through projects that are building the country's renewable energy capacity to meet, and eventually exceed, current targets. The recently inaugurated Shams 1 thermosolar facility demonstrates how renewable energy bolsters the entire value chain – from research and development (such as that at the Masdar Institute in Abu Dhabi), to manufacturing and on-the-ground power projects. Shams 1, with 100 Megawatts (MW) of capacity, is the first major step towards utilising renewable energy to meet domestic power needs.

It is also important to mention the US$350 million the UAE has allocated through the Abu Dhabi Fund for Development (ADFD) to innovative renewable energy projects in developing economies that offer potentially replicable solutions based on renewable energy sources and technologies. IRENA is assisting with the project selection for this facility. The first funding cycle of US$50 million in concessionary loans attracted great interest, with project applications amounting to over US$800 million. A panel of independent experts and an IRENA member advisory committee short-listed 16 projects; through this same process approximately 5 projects will be selected for final approval by the ADFD, and these will be disbursed in November. These short-listed projects are from various countries, and represent a variety of renewable energy sources and technologies.

These initiatives, along with the presence of IRENA's headquarters, all confirm the UAE's significant and sustained commitment to renewable energy and a sustainable future.

> "...as the benefits of renewables begin to be realised, Dubai and other governments will exceed their current targets..."

> "For the Gulf region, solar energy - including PV, concentrated solar power (CSP) and the various related technologies - hold obvious potential for huge developments"

What has changed at IRENA over this period?

Adnan Amin: After a two-year preparatory period IRENA was formally established in April 2011. The Agency has built a solid foundation and is now increasingly focused on fulfilling its mandate to promote the widespread adoption and sustainable use of all forms of renewable energy. IRENA has received extensive support from its host country and from the (more than) 160 countries we engage with, including 118 Members and 43 signatories or states in accession. To meet the requests of these members the Agency's programmatic and geographical scope has continued to expand. One of our newest activities is the Renewable Costing Alliance – a forum to enable us to engage with the private sector to gather and exchange the latest renewable energy technology cost and performance data. Other examples of our work include analyses of economic value creation through renewable energy, and the Renewables Readiness Assessment which enables countries to assess existing domestic development and deployment conditions and to identify actions required to improve them.

2. RENEWABLE ENERGY

How has the global market for renewable energy technologies changed in the four years since IRENA has been in existence in the UAE?

Adnan Amin: Total global investment in renewable energy was US$244 billion in 2012. This was lower than the record investment in 2011 but remarkably it was still six times higher than the 2004 figure. It is interesting to note that due to the falling costs of technologies, these lower levels of investment will result in higher levels of capacity being installed than in previous years. Another trend we are seeing, in IRENA and globally, is the increasing interest levels and renewable energy activity in developing economies. This was a highlight for investment in 2012 where investment in developing economies increased by 19% to US$112 billion.

Currently, on the global market, how competitive are renewable energy technologies compared to conventional ones?

Adnan Amin: Renewable energy is increasingly competitive even without subsidies in a growing range of situations. In developing countries reliant on diesel fuel, renewables are already a very competitive solution. In larger, more mature economies with significant coal, gas and nuclear capacities, the picture is more nuanced. Across the board, we can say that the competitiveness of renewables has improved very significantly in recent years.

Currently, large hydro power is the lowest cost option and this is why it represents 16 to 17 % of electricity generation today. On-shore wind is area-competitive with some countries such as Brazil receiving offers at US$43 per megawatt hour (MWh) of electricity produced. This would be competitive even in countries with low gas prices.

Utility-scale solar is still slightly more expensive than conventional power but costs are decreasing steadily. In addition to the falling costs in solar technology are the significant transmission and distribution savings related to the installation of rooftop PV. In countries with good solar resources where fossil fuels are not subsidised, it is already competitive. This is the case in Italy, Spain and the South Western United States.

A market where we are seeing the benefits and competiveness of renewables being recognised is in oil and gas exporting countries, such as those in the Middle East. Part of the reason for this is because when the opportunity cost of domestically consuming oil and gas is included in energy prices, renewable energy becomes increasingly competitive. This opportunity-cost driven business case has led a growing number of oil and gas exporting countries, particularly within the Middle East, to establish renewable energy targets and invest in installation.

What is your opinion on Dubai's renewable energy and energy efficiency targets - are they realistic, how easy will it be to meet them?

Adnan Amin: They are a very important step in the right direction. Importantly they reaffirm Dubai's commitment to energy diversification, which foresees increased reliance on renewable energy in combination with energy efficiency. Importantly, these targets are backed by concrete projects such as the Mohammed Bin Rashid Al Maktoum Solar Park, a planned solar PV plant, which will help meet Dubai's growing energy requirements while also supporting diversification and security of supply. I am confident that, as the benefits of renewables begin to be realised, Dubai and other governments will exceed their current targets.

What is IRENA's position on carbon capture and storage technologies?

Adnan Amin: IRENA has been established to advocate and promote the use renewable energy. While technologies such as carbon capture and storage could help to reduce emissions in the long run, renewable energy technologies will be an essential part of any global solution to address climate change.

Can you outline some renewable technologies that have good potential to change energy markets in future?

Adnan Amin: If I had to pick an area for investment, I would focus on electricity storage. Advanced biofuels, are also starting to gain momentum and are looking very interesting. There are many other promising fields; one is ocean power where a breakthrough could result in a transformation of energy markets especially for small island developing states. For the Gulf region, solar energy - including PV, concentrated solar power (CSP) and the various related technologies - hold obvious potential for huge developments. Other sources of renewable energy already contributing to the energy mix but which still have tremendous untapped potential include geothermal, hydro power and wind, all of which will play an important role in the future energy mix.

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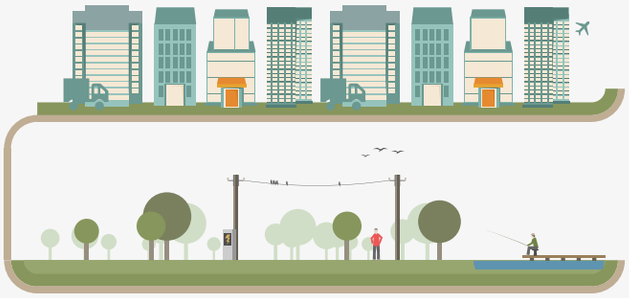


Suresh Perera still remembers the time in 1994 when his business proposal - to heat water using the power of the sun rather than electricity - was met with scepticism. "People said there was plenty of electricity and no one was interested," said Perera, explaining that the company, Solair Solar Energy Systems and their partner, Al Kazim Group, were the first on the market at that time.

Yet, not everyone shared this view. While there was initially no interest in installing the technology in large public and commercial buildings, solar hot water seemed like a good proposition to the owners of private villas.

"In the early 1990s, there was only the domestic market," he said. "There were many UAE nationals who promoted it and encouraged me, saying this is the future". While villa projects were small - with storage capacities of individual systems of 200 to 1,200 litres - they offered a base from where the industry could start growing, said Perera. The company completed its first large project, for the Etisalat training academy in Sharjah, in 1995.

According to Perera, it is currently the Government that is taking the lead in adopting solar hot water installations. And the support it offers is having profound effects for solar hot water companies. Among Solair's recent projects was installing systems with capacities of 10,500 litres each at 23 buildings for a public entity in Abu Dhabi. It has also installed a system that can produce 15,000 litres per day at the new Al Fahidi Market, a Dubai Municipality project. The system has been designed so that it can cater to the needs of 33 cafeterias and one large restaurant in the building.

"In the past six or seven years, business has picked up quite well, because the Government has taken the initiative," said Perera. Besides installing solar hot water systems in public buildings, the Government is also helping the industry by mandating the use of the technology in new private developments too. Since January 2013, Dubai Municipality requires all new single-owner buildings to install solar hot water systems, with a capacity to cover at least 75% of their needs. This has given another push to the market, said Jim Sebastian, Managing Director of Ecoval Trading, the UAE distributor for Solahart, an Australian solar manufacturer. "The market, especially the Dubai market has improved quite a lot," he said. Jim Sebastian said that while it will take another six months to a year for the new rules to show a dramatic effect "most new projects talk about solar hot water systems now. The future is quite bright because it has been mandated by Dubai Municipality".

Another issue driving the changes is price. In Dubai, hotels and commercial establishments pay AED 0.45 per kilowatt hour (kWh) for electricity, compared to AED 0.20 three years ago. This means that currently, the payback for installing a hot water system is usually around 2 years. This is why many of Sebastian's clients are the owners of existing buildings driven by the need to save electricity. Installing hot water systems works especially well for hotels, where there is one entity paying the electricity bill and where guests' expectations of comfort usually mean more hot water is needed. In residential buildings "the billing issue has been a problem", he said.

Perera stated the solar hot water market also had had a boost, due to the free-hold property boom in Dubai, with many expatriates (who had previous experience with solar hot water systems) installing them in their local properties. Besides having a positive impact for companies in the field, the uptake in solar hot water technology augurs well for Dubai's overall sustainability record. "Solar thermal technology is the first and cheapest solution for a green building," said Perera. "If correctly sized, you can get between 90 and 95 % energy savings. It is a win-win situation for everyone, if it is done properly."

To size a system correctly, it is important to check consumption portfolios in a building, as well as consider the type of building, its load patterns and consumption patterns, he said.

Both Perera and Sebastian agreed that since solar thermal systems work by collecting ambient heat, they have an advantage in the UAE over photovoltaic (PV) systems, which use the sun's light to produce power. Efficiencies of solar thermal collectors are much higher than PV technology, ranging from 82 to 96% for top-of-the-range systems."For a solar hot water system, the efficiency is very high 80 or 90%," said Sebastian. "Small amounts of dust do not affect the system so much and the payback is faster." To help reduce Dubai's overall power demand, the government should consider ways to encourage retrofits, said Sebastian. "The new projects are a very small fraction of the building stock," he said.

EXPANDING THE NETWORK

By Katarina Uherova Hasbani

Dubai reaches out to countries with successfully developed renewable energy sectors in comparable conditions to learn from international experiences and recruit strong partners for its ambitious plans.

Renewable energy promises energy diversification and reducing the impact of carbon dioxide. The Middle East has, in the past few years, demonstrated an impressive increase in how much attention it places on these promises. The pursuit of renewable energy has emerged at a crucial moment; just in time not to be left behind, but also allowing the region to benefit from the experiences of other countries. The Emirate of Dubai invited organisations from the Mediterranean region and Europe to a discussion forum on 27 May 2013 in Dubai to discuss renewable energy.

Over the past 5 years, the Middle East and North Africa has been the centre of ambitious plans to develop renewable energy projects. Currently planned targets amount to 107GW of installed capacity in MENA by 2030, according to the United Nations' International Renewable Energy Agency, IRENA. In North Africa, the proximity to and support from Europe has resulted in new solar and wind capacities being commissioned in Morocco, Algeria, Tunisia and Egypt. These developments have been encouraged by progressively harmonising the region's electricity regulations and integrating its electricity grid.

The Gulf Cooperation Council's (GCC's) member states, including the United Arab Emirates, hold the world's most-promising potential for development of solar energy sources. In the last few years, the region has seen a proliferation of projects and initiatives to realise this potential. Meanwhile, the European Union (EU) represents the global centre of expertise, both in terms of regulation and technology, for implementing renewable energy projects. In 2012, the EU held almost half (210GW) of installed capacity in renewable energy. The EU's presence is particularly strong in relation to solar PV; with 5 member countries having the highest PV installed capacity per capita.

While the EU has developed its lead in solar energy, Dubai has taken the initiative to invite representatives from the Mediterranean Renewable Energy Centre (MEDREC) and the Mediterranean Energy Regulators (MEDREG). This came as a logical next step after the announcement of the 1,000MW Mohammed bin Rashid Al Maktoum Solar Park and the ongoing construction of its first phase: a 13MW PV plant. The first roundtable dedicated to the topic of 'Mediterranean Initiatives on Renewable Energy and Prospects for GCC Countries' was organised jointly by the Dubai Carbon Centre of Excellence (DCCE), the United Nations Development Programme (UNDP) and MEDREC; and was held under the patronage of the Dubai Supreme Council of Energy. The event enlightened participants regarding the latest developments from renewable markets around the Mediterranean (such as the Mediterranean Solar Plan) renewable electricity trade and grid connections. Overall, it assisted greatly in identifying the topics where the rapidly-growing GCC market for renewable energy could learn from developments made in the Mediterranean and Europe.

Such collaboration is likely to result in an exchange of technological expertise on technical measures, one example being the integration of increasing renewable production in electricity grids. Undoubtedly, it has the potential to bring useful input in terms of policy and regulatory frameworks to be put in place as support for the development of business opportunities and attracting international investment.

It should be noted that the likelihood of a positive outcome of this relationship is asserted by the region's long history as a platform for the exchange of ideas and business opportunities and its relative proximity to the Mediterranean. Now that this new relationship has begun, it will be interesting to observe how, in a region which, (according Bloomberg New Energy Finance), in 2012 totalled 2.9 Billion USD of renewable-related investments, it will proceed.

ABOUT KATARINA UHEROVA HASBANI

Katarina is a Senior Analyst with Dubai Supreme Council of Energy, She has 10 years' experience in diverse energy policy issues from Europe and the Middle East.

GLOBAL OUTLOOK ON RENEWABLES

By Dr. Stephan Singer

> “ The time has passed when only a few countries dominated the renewable deployment scene ”

Investments into renewables
$US 250
billion annually

Renewables are growing quickly. Not accounting for traditional, inefficient (and often polluting biomass use) in developing countries for cooking needs; renewables accounted for about 9% of global energy demand in 2012.

Investments into renewables, mostly wind and solar, reached about $US 250 billion annually in the last three years 2010/12; this is almost five-fold the investments during 2004/6. Starting from almost zero in 2005, their double-digit growth rates in last years led solar and wind alone to provide about 4% of all global electricity supply. Maintenance of that growth rate in next decades will make solar and wind power the dominating sources of electricity worldwide.
Is it realistic? Yes, it is. It was suggested a few months ago by Bloomberg New Energy Finance that even under a ‘normal’ scenario for the power sector, wind and solar investments alone may reach $US 500 billion and therefore outpace by factor five those in fossil fuels and nuclear by 2035. By this summer, 138 countries have renewable energy and specific technology targets, most until 2020; and 127 of them have financial and political support schemes in place. The largest 2012 investments in renewables still occurred in the USA, China and Germany that also have the largest non-hydro renewable energy capacity. However, the time has passed when only a few countries dominated the renewable deployment scene. There are many newcomers on the scene, including countries one would not have expected earlier. OPEC countries like Algeria with a 40% renewable target until 2030 and Saudi Arabia with a 55 GW solar and wind electricity target for 2032. Spain and Portugal, hit hard by the European financial crisis, have a higher per-capita wind power deployment than Germany. The largest non-hydro renewable investment efforts by countries in recent years are led by South Africa and Italy who both spend almost 1% of their GDP mainly on solar and wind power. The top annual average renewable capacity growth rate over the last five years is championed by South Korea and Turkey with more than 30%. Market experts see Canada, Australia, Japan, Mexico, Philippines, Brazil, Morocco, UK and many other Least Developed Countries expanding rapidly into new renewable deployment.

There are many reasons for this bold global move; predominantly economic, social and environmental. Overall manufacturing costs for renewables, particularly for solar, went down by half in the last few years, while rising costs for fossil fuels, particularly for poor importing countries, leave a big burden in the state budget. Already today, off-grid solar is cheaper in most developing countries than the traditional diesel generator or lighting with kerosene lambs. For utility scale renewables, on-shore wind is already cost-competitive in many regions, not only with coal and nuclear but increasingly with gas also. Load factors of new wind power turbines have improved substantially. Combined with smart grids and wise management by transmission system operators, this sun-

> In 2012, with about 9% of total energy supply all renewables employed about 5.7 million people

ABOUT DR. STEPHAN SINGER

Stephan is Director Global Energy Policy for WWF International and based in Brussels. He is co-founder and member of the board of the Renewable Grid Initiative (RGI) in Europe that brings together NGO and grid companies (TSO) to work together cooperatively for a grid system accommodating a maximum amount of renewable electricity in a cost-effective and environmentally-friendly way. Stephan is also board member of WindMade, the first global standard-setting body for certification of uptake of wind and other renewables by industrial and commercial electricity consumers. In WWF Stephan directs the global efforts for a fully renewable powered, zero-emitting and sustainable energy economy by mid-century.

138 countries have renewable energy

filled summer in Germany almost the entire electricity demand (in some locations) was fuelled by roof-top solar and wind power over a few hours without any issues. A few years ago, a share of 10% 'intermittent' solar power in the supply mix may have caused severe stress by traditional energy suppliers in the third largest OECD economy. Also, in contrast to fossil fuels and nuclear, key new renewables such as offshore wind, new geothermal and Solar Concentrated Power (CSP) are expected, in the future, not only to provide much higher load factors than 'traditional' variable and weather-depended renewables such as photovoltaics or onshore wind. This will therefore reduce the need for back-ups but also continue to bring costs down.

Solar and wind have a much larger social and environmental benefit than fossil fuels and nuclear. To meet climate targets, they have zero greenhouse gas emissions. Furthermore, they do not emit any other air polluting gases impacting human health or nature. They have no highly toxic waste or discharge and do not need any freshwater during their operation which are substantial benefits over coal, gas and nuclear; particularly in drought-prone areas.

It also should be noted that renewables generate many more jobs per unit energy. In 2012, with about 9% of total energy supply all renewables employed about 5.7 million people, and therefore generated almost three times as many jobs as the 20 largest oil and gas companies worldwide that are providing more than 5 times the amount of energy worldwide. Job creation of renewables is a key benefit, particularly for developing countries with high unemployment and an increasing youth population.

In short, WWF is optimistic that renewables have all arguments and facts on their side to provide 100% of all energy by 2050. What has not been mentioned in this context are the tremendous challenges ahead to enable it to happen. It is clear that the proposed solution is not a straightforward process. It is unlikely the world will simply change its energy supply from coal and oil to renewables. In fact, it is probable that it will be a procedure that faces many obstacles. Politics and economics still favour the incumbents and protect them from perceived 'stranded' investments. Today, global fossil fuel subsidies ($US2 trillion annually - as assessed by the IMF recently) and global fossil fuel investments (with another $US1 trillion) still dwarf the combined financial support schemes. Investments into renewables –stand at less than $US400 billion. The job for politicians and businesses alike is to provide a true level-playing field for all energy sources and pricing all externalities, while transforming subsidies for fossil fuels into support schemes for clean renewables and energy conservation measures. Unfortunately, this is still a somewhat distant future and WWF and others need to foster important governmental interventions to create the needed and long-term security for clean energy investors.

03
DEMAND SIDE MANAGEMENT

We are led by the directives of HH Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, to be a role model for sustainable development.

We strive for energy-efficient usage while ensuring environmental sustainability in the Emirate of Dubai to achieve a 30% reduction in energy demand by 2030, a key objective of the Dubai Integrated Energy Strategy 2030.

Accordingly, we have developed the Demand Side Management (DSM) roadmap and action plan over the short-, medium- and long-term, to 2030. These include 8 DSM programmes and 24 initiatives covering all the potential saving areas associated with cost-benefit analysis, implementation mechanisms, financing mechanisms, and the Measurement & Verification methodology.

Implementation of this DSM plan will put Dubai at the forefront of energy efficiency in the region and beyond. contribute to the development of the green economy, and support the achievement of sustainable development in the UAE.

HE SAEED MOHAMMED AL TAYER

MD & CEO of DEWA

CHAPTER 3
DEMAND SIDE MANAGEMENT

By Pierre Langlois,
President, Econoler

Pierre Baillargeon
Vice-President, Econoler

MORE LIGHT AND WATER FOR LESS

On the challenging task of how to steer economies towards using less resources

> “The Dubai Supreme Council of Energy furthermore estimates the market value of retrofitting 30,000 buildings to be AED 3 billion by 2030.”

Energy efficiency started to be an issue for concern for government and facility owners after the first oil crisis of 1973, when an international oil shock drove petroleum product prices upwards. Industries and building owners reacted by considering the implementation of energy efficiency projects in their facilities. In those early years of the energy efficiency market, the vast majority of projects were carried out using a traditional construction approach. Engineering firms conducted energy audits of facilities followed by a design phase (drawing, specification, and bidding) and implementation of energy-efficient technology and control systems. The customer was paying for the project with internal funds or their own sources of finance.

At the beginning of the 1980s, new types of energy-efficiency initiatives emerged. Governments and electricity utilities realised the urgency of incorporating into their strategic thinking the mechanisms that would enable them to reduce their dependency on external events, like a fossil fuel price increases, in an increasingly-competitive and unstable market. It was against such a backdrop that a new management approach to energy resources was developed, initially in North America, experts felt that electricity-generating companies were in a strategically advantageous position to actively influence electricity demand. Born in the ‘80s, Demand-Side Management (DSM) was coined as a concept at an emergency meeting of senior managers from Edison Electric Institute (EEI) and the Electric Power Research Institute (EPRI) in 1983 in Chicago. The DSM abbreviation designates any initiative or programme designed to reduce energy usage by customers, based on their metered consumption. The term was widely adopted as it clearly differentiated this approach to the Supply Side Management (SSM), which focused on the planning of energy generation and import to

meet the energy demand of consumers.

DSM, on the other hand, focuses on reducing and optimising energy usage as an additional option to meet network demand at the lowest cost. DSM activities generally comprise a portfolio of programmes, each of them developed for a specific market segment or for specific technologies. These energy-efficiency programmes include promotional activities and, most of the time, monetary incentives for participants. The most common type of programmes provides financial incentives to end users but there are others programmes where incentives are provided to manufacturers or mid-market agents, such as importers or distributors. DSM programmes are often classified in two main categories. First is the so called ‘resource acquisition’ programme, designating initiatives with limited time duration where the objective is to acquire a certain quantity of kW demand reduction or kWh savings without a long term objective to modify customer behaviour and market operation. The second types of programme are ‘market transformation’ initiatives that aim specifically at removing market barriers to initiate or accelerate the adoption of more efficient equipment and, establish a permanent change in the market.

Because utilities lose revenues each time they reduce their sales of energy, they initially focused their DSM programmes on market segments or technologies where the cost of production and distribution was higher than the selling price. This was the case for low-income households, where special low rates were often applied as a social measure that resulted in loss of profit for the utility for each kWh sold. Another popular group of programmes were those targeting the peak demand period requiring utilities to build power plants, specifically for these periods and resulting in very high production costs for peak hours. This approach of focusing only on profitable market segments resulted in a limited scope for the development of cost effective DSM programmes.

The government had a slightly different perspective on DSM, their interest in applying the new concept to complement their energy strategy included: fostering the overall productivity, increasing competitiveness, optimising the utilisation of national energy resources and reducing the balance of payment deficits from imported energy. Rapidly, the government started to put an obligation on utilities to deliver a certain quantity of energy-savings in a specified number of years, and ultimately, this brought about the regulatory aspect of DSM.

“The Rediscovery of Demand Side Management,” The Brattle Group, 2012.

3. DEMAND SIDE MANAGEMENT

How legislators can stimulate DSM

Legislators are key players in the development of DSM because they can put obligations on utilities to deliver demand reduction and energy savings. Several countries, states or provinces have put in place such obligations on energy distributors operating in their territories. The government, or an energy regulatory body created by the government, determines the appropriate targets for energy savings to be achieved and supervises the implementation of DSM activities by the utilities and programme evaluation of these activities. For example, regulators usually require utilities to present detailed plans and budgets of the DSM programmes for approval before the utility can start to implement the programme.

As a result of utilities losing revenues and profitability when they develop and implement energy efficiency programmes, a funding mechanism must be designed and implemented by the regulator. This could be funding through a small increase in energy rates or a separate charge added to energy bills to cover DSM programme costs. In the USA, a version of this mechanism, called the Public Service Charge was introduced at the beginning of the 90's and is still largely in use. A study by Barbose et al. in 2009 concluded that 35 states in the US had put in place such a mechanism and had invested USD 3.1 billion by the end of 2008. The study also concluded that the trend was rapidly increasing and that USD 7.5 billion will be invested by 2020.

In the European Union, the obligation on utilities was introduced with the recent Energy Efficiency Directive (2012/27/EU) which decrees that DSM programmes be developed and implemented on a much larger scale in years to come.

Different schemes exist for DSM programme financing through a Public Service Charge. The simplest model allows the utility to recover part, or the totality, of the money invested in the implemented DSM programme. This model does not allow the utility to be compensated for the loss of profit resulting from reduced sales of energy, and thus does not offer strong incentives to ensure the success of the programmes implemented. Other schemes designed as 'decoupling' are based on an analysis of the loss of profits resulting from the reduced sales, and will compensate the utility so its profitability is maintained. This scheme thus 'decouples' sales from the profitability of the utility and provides a better incentive to the utility. More advanced schemes provide utilities with decoupling plus a bonus for the achievement of certain target in energy efficiency. The bonus will result in the utility being more profitable reducing the energy consumption of its clients than in selling more energy. This scheme is currently used by the California Public Utility Commission to provide incentives to utilities within its jurisdiction. The most appropriate scheme for any given jurisdiction must be analysed carefully: taking into consideration the number of utilities operating in the market, the objectives of their shareholders and the protection of public interest.

Another important aspect of DSM programmes is the cycle of programme evaluation. Due to DSM programmes being ultimately paid by the public's (i.e. end users) money through the financial recovery mechanism. The government or the energy regulator wants to ensure that the programme implemented is well-managed and delivers the expected results. Thus the concept of a mandatory independent review of programme results by specialised 'programme evaluators' was introduced. At the end of each programme cycle, the utility has to mandate an independent firm that will apply state of the art evaluation techniques to quantify the programme's results. The evaluation may include four components, namely: Process Evaluation, Market Evaluation, Impact Evaluation, and Cost Effectiveness Evaluation. At the end of the evaluation process, the evaluator will make recommendations to correct inefficiency in programme delivery and to optimise the cost effectiveness and the ability of the programme to deliver the expected savings. Here again, the legislator or energy regulator will review the evaluation report results and may mandate changes utilities must implement.

Energy Service Company (ESCO)
A legal entity that delivers energy services in a user's facility under an EPC agreement.

Energy Performance Contracting (EPC)
Contractual arrangement between a beneficiary and a service provider for an energy efficiency project implementation, where the investments in that project are paid for in relation to a contractually agreed level of energy efficiency improvement.[This duplicates some of the RSB article]

The role of Energy Services Companies (ESCOs) and Energy Performance Contracting (EPC) in DSM programmes

ESCOs can play several roles in the development of DSM activities within their markets. For instance, they can act as an intermediary between their customers and local utilities to prepare and implement turnkey projects that will take full advantage of the available financial incentives offered by utilities' DSM programmes. The ESCO could market the programme to their customers. They can also support them in completing participation forms and providing engineering calculations or simulations to estimate energy savings from the project when it is requested by the DSM programme owners. It is important to note that DSM programmes that target large-scale energy users rely more and more on a comprehensive Monitoring and Verification (M&V) process to determine the savings associated with energy efficiency measures and determine the financial requirement. This is an area where ESCO can apply their know-how to produce a robust demonstration of energy savings to the utility.

ESCOs can play an even larger role for DSM programmes that are designed to be 'bidding' initiatives. In these programmes, the utility requests proposals from market actors (ESCOs, Program managers, energy efficiency specialised firms) under a bidding process to deliver a certain quantity of kilowatt demand reduction or kilowatt per hour savings. This bidding process generally allows a wide spectrum of proponents in the selection of target market, technologies and promotion and communication methods to enrol potential customers. ESCOs, with their knowledge of the market and of how to develop, sell and implement EPCs, can be the partner of choices for utilities relying on a bidding process to deliver energy savings.

In the newly-introduced European Union Energy Efficiency Directive, there is a possibility to allow ESCOs to become producers of certified energy savings. If this mechanism is implemented in member states, ESCOs could develop energy-efficiency projects and measure the results according to a M&V process mandated by the country's regulations, and then offer certified energy savings for sale to a utility. These savings can then be used applied towards their obligations.

In some markets, ESCOs are created within utilities to deliver energy services, an interesting way to combine DSM objectives with utilising the EPC mechanism. This type of utility-owned ESCO can be found in several countries; examples being Croatia (HEP ESCO), Spain (Union Fenosa) and Switzerland (SIG energy services).

In addition to participating in utility DSM programmes, ESCOs and EPC can play major roles in the implementation of energy-efficiency programmes run by energy agencies or by the government. For example, government improvement programmes like the US Federal Energy Management Programme rely in large part on ESCOs to implement EPC in federally-owned properties. To date, EPC has delivered cumulative savings of USD 7.2 billion from an investment of USD 2.7 billion in energy-efficient and renewable technologies.

EXAMPLES OF ESCO PARTICIPATION IN ENERGY-EFFICIENCY INITIATIVES

ESCO participation in energy-efficiency efforts can be found in several countries. The North American market has been well established since the 80's and ESCO business opportunities continue to grow due to the introduction of more aggressive targets for energy efficiency by government.

In Europe, Germany is the largest market with more than 500 ESCOs operating. The energy supply contract is still dominated by national ESCOs but several international ESCOs are also active offering others forms of EPC, namely the shared saving agreement and the guaranteed saving agreement. The UK is a very dynamic market, with about 30 ESCOs operating, including several international and some domestic companies. Italy's market has 100 ESCOs and is growing due to a provision in white-certificate regulations that allow ESCOs to generate white certificates and sell them to utilities. Belgium has developed an interesting scheme for the public sector with the creation of FEDESCO: a Super ESCO that supervises the work done by several others ESCOs in the market.

The Asian market has seen a rapid progression in the number of ESCOs. China is perhaps the most impressive demonstration of ESCO growth. The concept was introduced in 1998 (for 3 ESCOs) followed in the mid 2000s by rapid growth culminating in 500 ESCOs at the end of 2011.There, a special financial incentive scheme, developed by the government for energy efficiency projects, has undoubtedly provided the impulse to ESCO development. South Korea's market is also active with USD 100 million per year of projects implemented and incorporates a low interest finance scheme (managed by Kemco).

3. DEMAND SIDE MANAGEMENT

Learning and implications for Dubai

The huge success of ESCOs all around the world since their initial emergence suggests that this mechanism could be a significant component of Dubai's energy efficiency strategy for the future.

Dubai already has some ESCOs operating in its market, including Energy Management Services (EMS), the first ESCO in Dubai in 1991, and a few others players including Pacific Controls, Veolia Azalia and Zamil Industrial from Saudi Arabia. International companies like Schneider Electric, Trane, Dalkia, Tata solutions and GDF Suez are also making progress in the market.

Etihad Energy Services was created recently as a Super ESCO by Dubai Electricity and Water authority. As a Super ESCO, this organisation can help to structure the market by supervising the work done by other ESCOs. The Super ESCO model brings several notable features to the market, the primary being the credibility of a government-owned enterprise that will help to increase market penetration of EPC. The Super ESCO also facilitates harmonised standards for energy audits, contracts and M&V procedures.

Lessons learned from the international market show that ESCOs can develop by themselves under the right conditions. However, support programmes from government are often needed to help remove some of the numerous market barriers in the initial stages of development. Those support programmes include promotion of energy efficiency through EPC, training programmes for ESCOs or for building owners that want to apply the concept, certification of individual experts and Certification of ESCOs. Financial support, such as reduced interest loans, soft loans or partial guarantees, are also important to help smaller ESCOs with limited access to financing to enter the market. Key elements of a suitable regulatory framework to foster the ESCO market in Dubai are being developed by its Regulatory and Supervisory Bureau for Electricity and Water.

The potential is enormous. 19 terawatt hours and 47 billion imperial gallons of water could be saved by 2030 through cost-effective demand side management. The Dubai Supreme Council of Energy furthermore estimates the investment associated with retrofitting 30,000 buildings to be 3 billion AED till 2030 – an attractive market for ESCOs looking to engage in Dubai.

ESCO development is definitely underway in the United Arab Emirates and planned support policies will help to accelerate its development as a contributor towards a more efficient and sustainable economy.

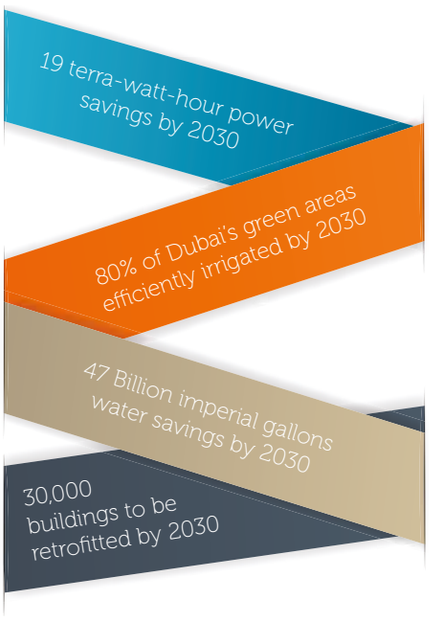
ABOUT PIERRE LANGLOIS

Pierre is recognised as a first-rate international expert in the development and implementation of pioneering energy efficiency financial mechanisms, more specifically, in ESCO start-ups and operation in industrialised and developing countries with more than 25 years of experience in over 50 countries. He is a member of the board of directors of several ESCOs worldwide and the Efficiency Valuation Organization (EVO).

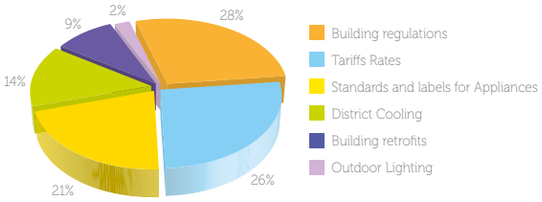
ABOUT PIERRE BAILLARGEON

Pierre has over 30 years of experience in many energy efficiency-related sectors, including the design and implementation of DSM programs, building codes and energy efficiency standards, as well in market based approached such as Energy Performance Contracting (ESCOs). He carried out or financed projects by international institutions as well as bilateral or multilateral development organisations and utilities in over 55 countries including the Middle East.

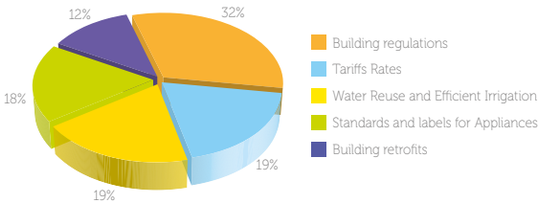
Dubai's DSM Potential



Dubai's power savings potential by DSM areas 2013 - 2030



Dubai's water savings potential by DSM areas 2013 - 2030



Source: Dubai Supreme Council of Energy 2013

"As demonstrated in Europe and North America, the use of Energy Services Companies (ESCOs) and Energy Performance Contracting (EPC) has widened to improve the energy efficiency of existing buildings which is a key element of any Demand Side Management (DSM) Strategy. In response to the need for the development of energy efficiency projects, and to contribute to the Dubai Integrated Energy Strategy (DIES) 2030 objective of 30% energy savings by 2030, the Dubai Electricity & Water Authority (DEWA) made a strategic decision to establish a Super ESCO under the name of Etihad Energy Services Co (Etihad ESCO).

Etihad ESCO was formed in June 2013 as a fully owned subsidiary of DEWA, the Dubai utility and member of the Dubai Supreme Council of Energy (DSCE), with a laser focus on developing projects to reduce the energy consumption of existing buildings. Etihad ESCO will help building owners and government entities to initiate and formalise energy efficiency projects, check the potential for energy savings, which will then ensure the ESCOs successfully provide their services to reduce the energy consumption of the buildings for the long term. Additionally, as funding is often a barrier to make the energy efficiency projects real, Etihad ESCO will also focus on facilitating access to finance for the ESCOs through forming relations with financial institutions. Etihad ESCO is already working on a number of projects and the first concrete results are expected in 2014."

Stephane le Gentil,
CEO, Etihad ESCO

الاتحاد
Etihad
لخدمات الطاقة
Energy Services

Interview

Interview: Hany Ayesh

The Super-ESCO as Superhero

How Etihad Energy is planning to kick start the Dubai Energy Performance Contracting Market

'...the Super ESCO model is necessary to accelerate the development of a professional and viable ESCO market.'

الاتحاد
Etihad
لخدمات الطاقة
Energy Services

Earlier this year, Dubai witnessed the establishment of the first large-scale, utility owned Energy Service Company (Super ESCO) of the GCC - Etihad Energy Services. This will drive the creation of a viable ESCO market by supporting the capacity building of local energy service companies. It also supports the public sector by enabling the performance contracting model to drive deep energy efficiency retrofits into this largely untapped sector. Super-ESCOs are typically established by the local utility or relevant government authority, as in the case of Dubai, by the Dubai Electricity and Water Authority (DEWA).

Mr. Ayesh, why did DEWA invest in the establishment of a Super-ESCO?

Hany Ayesh: In a global context, especially in reference to the developing world, ESCOs face a lot of barriers when attempting market entry. The main barriers include a lack of access to third-party financing, the lack of regulation that governs the relationship between the end-user and the ESCO, as well as a limited awareness among end users towards the innovative model that ESCOs typically operate under. All these barriers, that were observed globally, are hindering the growth of the UAE ESCO market. This is why the Super ESCO model is necessary to accelerate the development of a professional and viable ESCO market which will ultimately help achieve the demand reduction targets, as set out in the Dubai Integrated Energy Strategy 2030.

How will a Super ESCO add value to the current market?

Hany Ayesh: A recent study commissioned by the Supreme Council of Energy, revealed many of challenges local and international ESCOs face if they wanted to operate in the UAE market. Based on success stories from other countries, Super ESCOs have the ability to address the specific performance contracting needs of the local market and potentially stimulate the creation of a vibrant ESCO industry. The key measure of success for Etihad Energy Services will be the growth of the performance contracting market and additional successful market entries by professional ESCOs (some of which are currently reluctant to operate). A key role that we hope to play will be to interface with end-users who have viable energy efficiency projects, finance the right projects and subcontract individual ESCOs for project implementation. Once a track record of successful ESCO projects is developed, the vision is that the market participants will become comfortable with this innovative model and the barriers will gradually diminish and the ESCO companies will be very competitive on their own.

> “Performance contracting is a unique arrangement that allows building owners to make necessary improvements while investing very little money up front.”

What is performance contracting exactly and what benefits does it provide for building owners?

Hany Ayesh: Performance contracting is a unique arrangement that allows building owners to make necessary improvements while investing very little money up front. The contractor assumes responsibility for installing energy efficient equipment, and also for the maintenance of the equipment throughout the performance contract period. The contractor is paid based on the performance of the installed equipment, assuming much of the financial risk in reducing energy consumption over, typically, five to ten years. In essence, it is an off-balance sheet tool that enables building owners in the UAE to achieve their energy reduction goals and green certifications.

The beneficial aspect of performance contracting is that it completely removes the tendency of contractors to cut corners on construction and other phases of project implementation because they have a strong incentive to exceed savings targets. For example, if the project financing duration is for five years, the equipment will be guaranteed to save on expenses and work at an optimal efficiency for that period.

3. DEMAND SIDE MANAGEMENT

> "The beneficial aspect of performance contracting is that it completely removes the tendency of contractors to "cut corners" "

The ESCO model seems to offer an exciting financial proposition but who are the best candidates for the ESCO model?

Hany Ayesh: The best candidates are properties or facilities with severely constrained budgets and have difficulty accessing the necessary capital. When companies are constrained by low-maintenance budgets, they will generally execute the quick win energy efficiency retrofits, but rarely enjoy the benefits of deep energy retrofits. Often, customers lack enough in-house staff or resources to properly manage and implement energy efficiency retrofit projects. End-users should consider professional performance contracting as an outsourcing avenue for their energy reduction needs so that they can focus on their core objectives.

Can you elaborate for us on specific hurdles for ESCO market participants?

Hany Ayesh: It was observed in many countries with developing ESCO markets that their purchasing model for ESCO services unwittingly replicated existing administrative rules and tendering processes for traditional contracting activities without any adjustment to the differently natured market. For example the bidding process typically attempts to obtain services at the lowest cost for the customer, without fully assessing the financial appeal of the proposals. Also, the tendering process had drawbacks and several ESCOs simply refrained from bidding due to unnecessary complications and taking on the risk of upfront investment of time and money without any guarantee of award or payment. The process can be very lengthy and this is a strong deterrent, especially for small ESCOs. Typical requests for proposals (RFPs) usually include an investment-grade audit report, and the baseline data conclusions from the ESCO rarely concur with the baseline data concluded by the building owner's energy audit report. As a result, the two parties are often in conflict. Etihad Energy, as a Super ESCO, will build mutual trust amongst the various stakeholders and support a streamlined process for performance contracting; which will be localised for the UAE market.

What lies ahead for Etihad Energy Services as Dubai's first Super ESCO?

Hany Ayesh: Though Etihad Energy Services was just formed recently, I am pleased that we have already been awarded a major project and are diligently exploring an impressive pipeline of projects. This gives us a strong signal of market interest in our services. Our portfolio of services includes energy auditing and benchmarking, performance contracting consultancy and financing of energy efficiency retrofits for financially attractive projects.

We are also collaborating with major financial institutions and various Dubai entities such as the Dubai Supreme Council of Energy and the Dubai Regulatory & Supervisory Bureau (RSB) on initiatives related to regulations and standards for this promising industry and also Dubai Carbon for project development. I feel we have an eventful time ahead of us.

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ENERGY SOLUTIONS FOR A COMPLEX WORLD

Tetra Tech provides consulting, engineering, program and construction management, and technical services worldwide. We offer clear solutions for water, environment, energy (conventional, wind, solar, hydropower, and nuclear), infrastructure, and natural resources challenges.

Tetra Tech has completed more than 1,000 power projects. We have transformed utilities, developed policy and regulatory and commercial frameworks, and helped develop smart metering and grid infrastructures.

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- Capability Development

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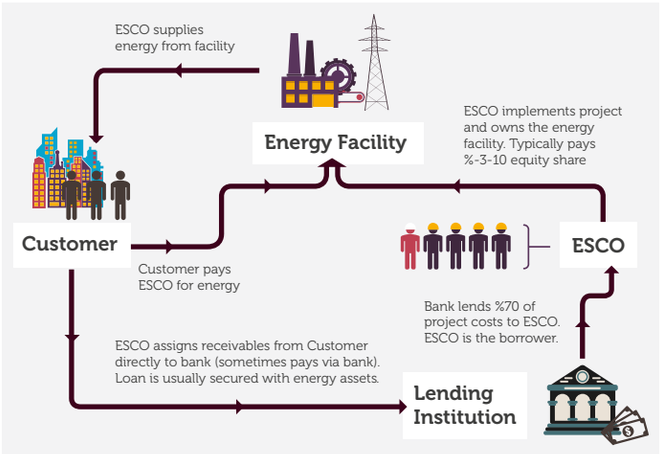
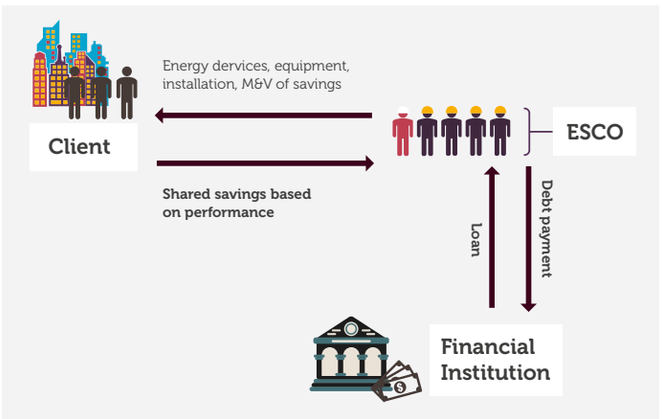
Guaranteed savings

- The ESCO guarantees a level of energy saved against a base-case
- Requires credit-worthy customer and sophisticated financial sector
- Customer takes energy price risk
- The customer finances the project through his balance sheet, the ESCO does not become highly leveraged
- Require monitoring and verification to ensure customer is following procedures
- More comprehensive coverage of all types of project

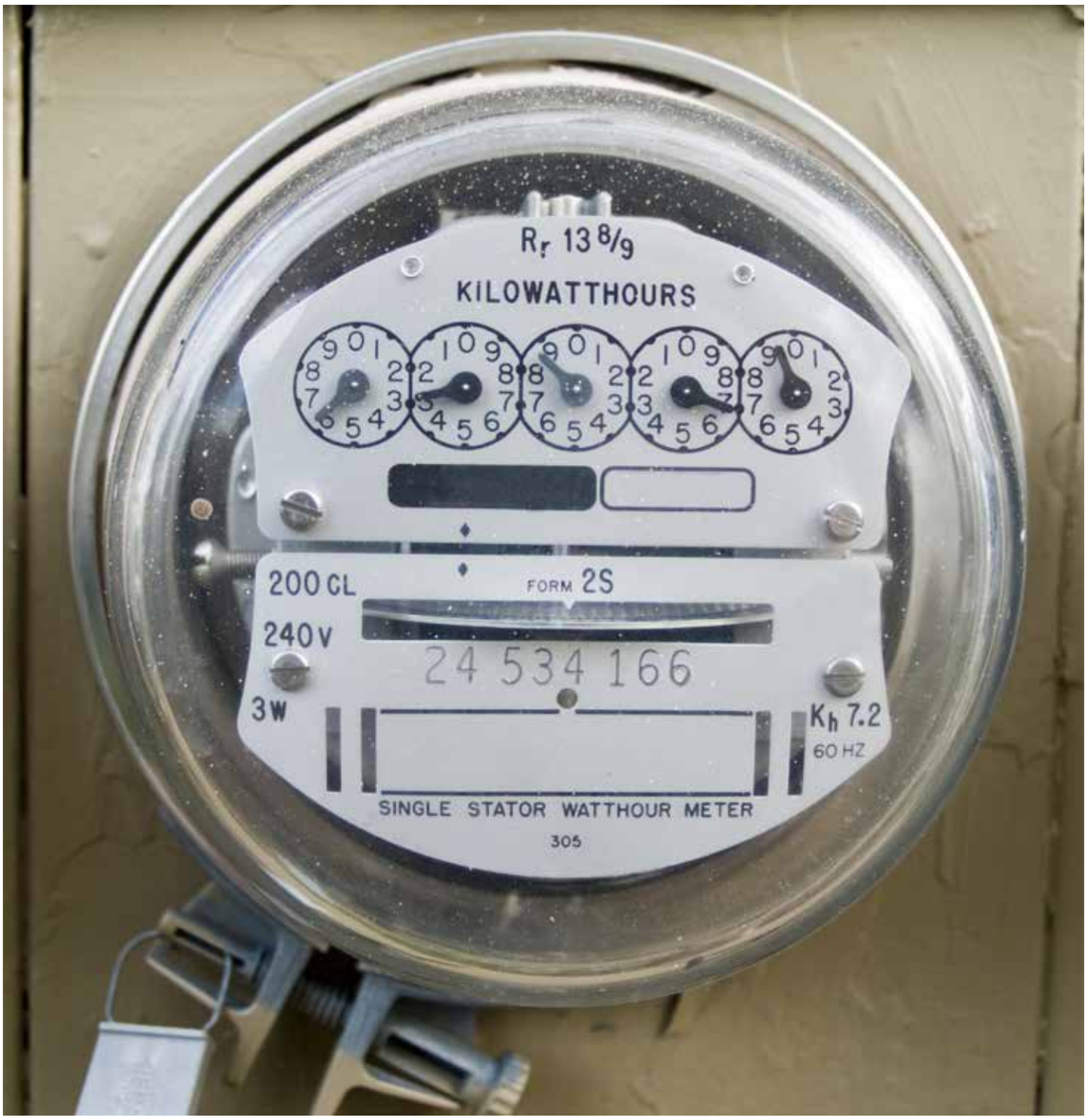


Shared savings

- The ESCO receives a share of actual energy savings (typically 85%) during contract life
- Customer does not need access to credit but financing costs are higher
- ESCO is exposed to energy price risk
- The ESCO finances the project through its balance sheet which favours large ESCOs as small ones will become highly leveraged
- More complex contracts and negotiations
- Focus on projects with quick payback



PUTTING ESCOs ON TRACK



“ Energy Service Companies (ESCOs) are seen as a potential vehicle in this retrofit market ”

> “The US ESCO market is valued in excess of $4,000m (AED14,700m) and growing at 10-15% per annum”

The Regulatory and Supervisory Bureau (RSB) has a plan to nurture the Dubai ESCO market

Dubai has set ambitious targets to improve the efficiency of energy use in the Emirate; aiming for a 30% improvement by 2030. Building codes can raise the efficiency of new buildings, and standards for appliances can remove inefficient equipment from the marketplace, but a mechanism is also needed to improve energy performance in Dubai's 130,000 existing buildings. Energy Service Companies (ESCOs) are seen as a potential vehicle in the 'retrofit' market.

The distinctive feature of ESCOs is that they offer, 'performance contracting.' They take on the risks for the delivery of energy-saving measures proposed to a client. A number of firms already offer ESCO services in Dubai, including some of the big international players, but there is a widely-held view that the full market potential remains untapped. The US ESCO market is valued at in excess of $4,000m (AED 14,700m) and is growing at 10-15% per annum.

At the Regulatory and Supervisory Bureau (RSB), we have examined what could be done to encourage this market by identifying both the opportunities and challenges. Our investigation highlighted key market barriers such as: gaining the confidence of clients in realising savings proposed by ESCOs, complex and difficult to understand contracts causing uncertainty, lack of an accepted process to measure and verify savings, and reluctance to enter into agreements which were seen as having a high chance of ending up in dispute.

Over the past few months we have been working to build a framework to strengthen the ESCO market in Dubai.

An accreditation scheme for ESCOs – accreditation gives confidence to clients considering engaging the services of an ESCO and banks or other financial institutions considering financing ESCOs.

Standard Contracts – writing an energy performance contract from scratch can be a daunting prospect, even for those with some experience of contracting for energy services. Standard contracts reduce this cause of stress, and are an efficient way to build confidence in the market. We have worked with stakeholders to design two standard contracts; these are based on the two most widely-used energy performance contract models: Shared Savings and Guaranteed Savings.

Measurement and Verification – The measurement of savings can often be clouded by changes to the environment. For example, business growth may offset energy efficiency savings, or seasonal changes may affect the financial savings made by the client. We have worked with the industry to develop a standard measurement and verification protocol, which helps both clients and ESCOs see what energy savings have been made, thus reducing the likelihood of disagreements later in the project.

Dispute Resolution – a dispute resolution process provides an opportunity to settle issues without immediate escalation to the courts. This process has been built into the standard contracts to give added confidence to ESCOs and clients alike.

To increase market activity, our aim has been to tackle all challenges strategically, allowing the market to develop in the most natural way possible.

The prize of energy efficiency is now more readily available to public and private sector clients in the form of lower bills and reduced carbon dioxide emissions. ESCOs now have an enhanced opportunity to develop their business in Dubai, contributing to the delivery of the Dubai Integrated Energy Strategy in the process.

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 UAE.

EMIRATES NBD SPEARHEADS ENVIRONMENTAL FINANCE

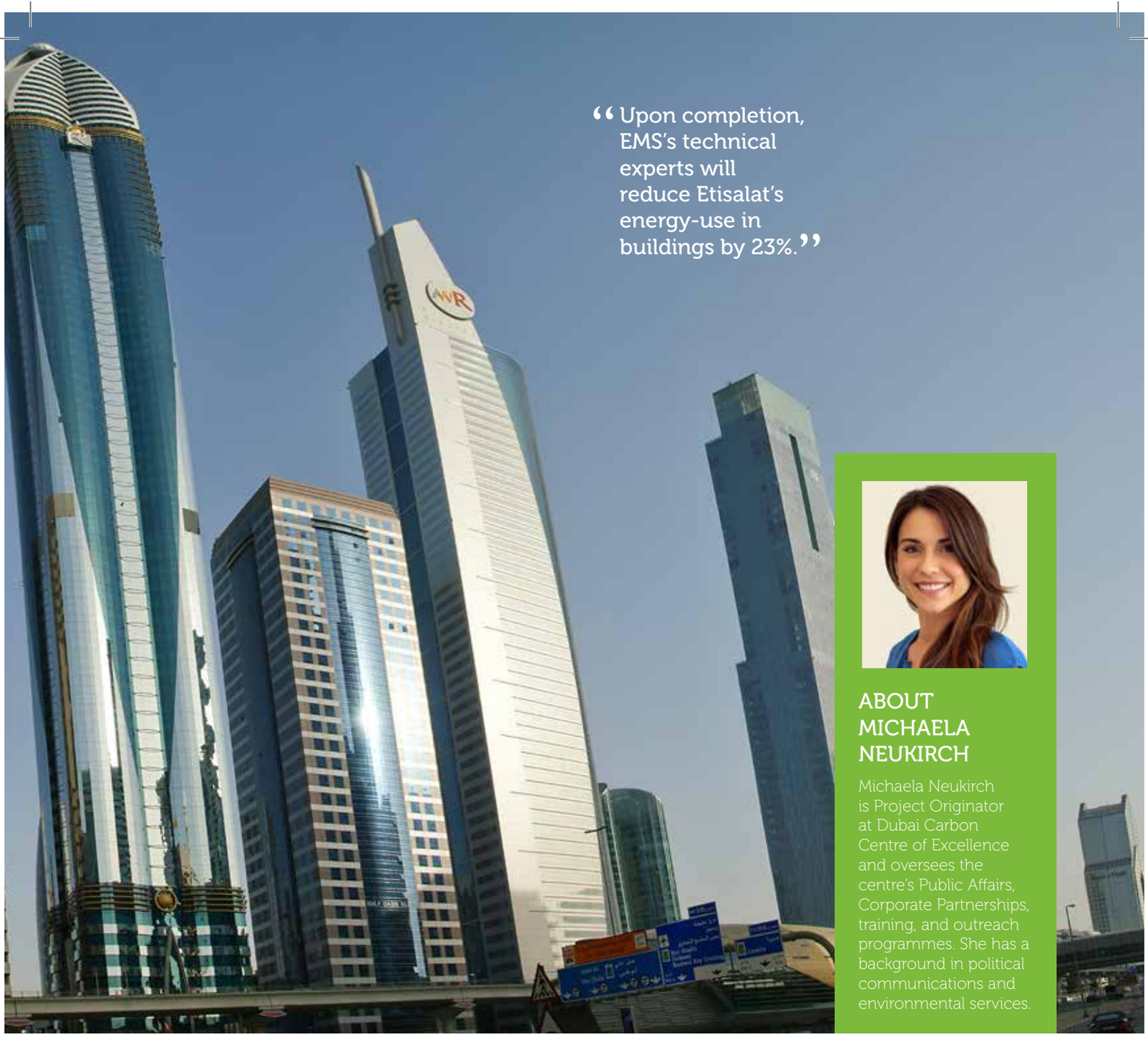
EMS and Dubai Carbon Centre of Excellence, in collaboration with Etihad Energy, debut Shared Savings Energy Performance Contracting (EPC) in the UAE. The project will be financed by Emirates National Bank of Dubai (ENBD), and has the potential to be a watershed for energy efficiency services in the Emirate.

Governments and businesses view Energy Performance Contracting (EPC) as a major catalyst for essential retrofits that are required in some of Dubai's existing buildings. Whilst legislation and contract templates are currently being developed, the first EPC project in the UAE is already in progress.

Energy Management Services (EMS), a regional Energy Service Company (ESCO), is implementing a large-scale efficiency programme for all of the buildings owned by UAE telecommunications incumbent, Etisalat. Upon completion, EMS's technical experts will reduce Etisalat's energy-use in buildings by 23%. The first phase of this project is focused on Etisalat's buildings in Dubai, with upgrades in Abu Dhabi and the other Emirates to follow upon completion. In total, the programme will roll out in 358 buildings across the UAE, and is amongst the largest of its kind in the Middle East and North Africa.

EMS finalised the initial project plan in early 2012, but the novelty of the business model meant that financial institutions had to develop proper systems to address certain requests and conduct proper due diligence. This is when Khaled Bushnaq, CEO of EMS, partnered with the Dubai Carbon Centre of Excellence (Dubai Carbon), which was already working on structuring finance for a pilot project using Energy Performance Contracting (EPC), using the shared-savings model from the Dubai Supreme Council of Energy

From the early stages, all parties involved recognised the significance of the first large-scale ESCO project as demonstration of the feasibility of such contractual agreements. EMS and Dubai Carbon have first-hand experience of how retrofits offering considerable energy savings with attractive return of investments were not able to come to fruition, as clients and banks were



> “Upon completion, EMS’s technical experts will reduce Etisalat’s energy-use in buildings by 23%.”

ABOUT MICHAELA NEUKIRCH

Michaela Neukirch is Project Originator at Dubai Carbon Centre of Excellence and oversees the centre’s Public Affairs, Corporate Partnerships, training, and outreach programmes. She has a background in political communications and environmental services.

sceptical. Under its Green Initiative 2012, Etisalat – as the client -was willing to be a pioneer, and the ENBD team, managed by Teena Antony, was willing to study the associated complex EPC contracts, spread sheets and agreements. ENBD proved itself to be more than able to spearhead environmental finance, while other banks preferred to wait for pilot projects.

The implementation itself is based on a capital lease agreement between Etisalat Facility Management (eFM) and Energy Management Services (EMS) to provide the service, whilst Dubai Carbon, in collaboration with the newly-formed Super ESCO Etihad Energy, will procure more than AED 9 million for the Dubai stage of the project through their own funds and the credit facility with ENBD. Etihad Energy Services was recently formed as a subsidiary of Dubai Electricity & Water Authority to act as a Super ESCO to precisely support innovative projects like this and overcome typical hurdles in the market. As a part of the scheme, EMS and Dubai Carbon will recover the investment from energy savings achieved as result of the measures. In addition, the ten-year partnership is expected to generate profit from energy savings, with dividends to be allocated amongst the parties following the shared savings model. By including a bank loan, the project’s internal rate of return (IRR) jumped to attractive double digit figures; further encouraging the DCCE board of directors to proceed.

All Etisalat buildings in Dubai will be retrofitted by early 2014, and the entire project will be implemented throughout the UAE by the end of 2014. The initiative will include several energy efficiency measures such as adjustments to reduce the energy use of air-conditioning systems, retrofitting lighting system with efficient light-emitting diode (LED) lights and movement sensors to ensure lights are switched off when not required as well as Remote Monitoring & Control amongst others.

Etisalat is currently evaluating the feasibility of rolling out similar programmes throughout the region. Using this first project as an example, it is believed that market- and and investor-confidence will rise. Considering the value of these projects, 2014 may be the year that Dubai ‘shares the savings.’

Interview

Interview: Ali Bin Abdullah Al Owais

Chairman, Regulatory and Supervisory Bureau (RSB)

مكتب التنظيم والرقابة لقطاع الكهرباء و المياه
RSB. for Electricity & Water Sector

Can you share the RSB's short, medium and long-term objectives, considering the exponential growth in energy and water demand in Dubai in recent years?

Ali bin Abdullah Al Owais: Dubai's energy future will be characterised by a greater focus on energy efficiency, fuel diversification, the increasing use of renewable energy, and harnessing private sector finance and innovation. Our role, firstly, is to design a regulatory framework that supports the themes I've just mentioned, which will help to deliver the 2030 energy strategy. From design, we then have to move to implementation; ensuring that new entrants into the energy market meet high technical standards so that consumers are protected. We've begun work on the framework that will encourage renewable energy and allow Dubai's first independent power projects. Beyond that, I see us having a very full agenda in creating a comprehensive approach to energy efficiency, where we'll have to work closely alongside other players, such as Dubai Municipality and Dubai Electricity and Water Authority.

How has the response been towards existing regulatory frameworks, such as the Dubai Integrated Energy Strategy 2030, within the public sector?

Ali bin Abdullah Al Owais: The development of the Dubai Integrated Energy Strategy 2030 has created a platform around which the whole energy sector in Dubai can rally, and has come to be seen as something of a model for others looking to transform their own energy use. I see a real thirst to be involved, often at a very practical level in terms of improving energy use in public sector buildings.

In the case Dubai is the successful bidder to host Expo2020, an influx of residents and tourists is expected in the lead up to the event, placing an added strain on the emirate's energy and water demands. What role do you foresee the RSB playing in supporting and regulating this demand?

Ali bin Abdullah Al Owais: Of course, we're all eagerly awaiting the November announcement of the successful bidder. I'm particularly pleased that one of the themes of the Dubai bid is sustainability – lasting sources of energy and water. This provides a great opportunity to make the Expo itself and the way Dubai caters for the demand of the many visitors sustainable. Expo 2020 is naturally an important staging post on the way to achievement of the 2030 strategy, so by then I'd expect that there would be clear evidence of our regulatory approach to improving energy use and a strong role for renewable energy in meeting new demand.

As the emirate sees a focused interest in demand-side management, what is the RSB's strategy in building markets for energy sector services?

Ali bin Abdullah Al Owais: The important word in your question is 'markets.' We want qualified energy service companies and clients to feel confident in doing business with each other in a well-regulated market that doesn't stifle innovation and choice and also builds trust. There is a range of potential incentives that we can consider. One area is in making the energy efficiency of buildings more transparent through energy audits whose results can be made known to potential tenants or owners. Another area is sub-metering, ensuring people know how much energy they use and that they can influence how much they pay by being energy-conscious. These sorts of measures can support the underlying incentives that there are plenty of cost-effective measures that building owners can undertake that have an excellent payback: whether it's air-conditioning improvements, lighting upgrades or more efficient appliances.

What is the RSB's position on providing incentives for large-scale solar photovoltaic installations for industrial, commercial and domestic use?

Ali bin Abdullah Al Owais: Solar panels aren't yet competitive with large-scale conventional generation, so some regulations will probably be needed to kick-start the market in Dubai. But we need to proceed cautiously; some other countries have ended up with an unaffordable subsidy regime through overestimating solar costs and underestimating the growth of solar that would be produced by generous feed-in tariffs. So we think there's merit in proceeding cautiously; getting better data on the costs of solar in Dubai. In principle, there's no reason why there can't be a mixture of larger installations at commercial and industrial premises and panels on the roofs of many of Dubai's villas. The added benefit of getting the domestic sector involved is that it creates a stronger link with energy issues and the conservation message.

DUBAI - TODAY'S IDEAL HUB FOR ENERGY EFFICIENCY

Efficiency is the fastest and cheapest way to reduce energy and water consumption. Today, it's is being integrated throughout the Emirates. Some obstacles remain.

Residents carefully turn off unwanted appliances and light their homes with low-energy bulbs. Windows in tall glass skyscrapers are shaded with special coatings to cut out solar radiation. Gardens, featuring drought-tolerant native plants, are irrigated with drips delivered by underground pipes. Air-conditioning is modulated by smart control systems to cool buildings before the midday peak in demand. Air filters are cleaned regularly to maintain optimum performance.

> "Efficiency gains consist of many small measures which take patience and expertise to identify and implement; a task beyond overworked householders and building managers."

Such measures can form part of a radical improvement in the way the Gulf countries use energy. Dubai is taking the lead with the Dubai Integrated Energy Strategy, which targets a 30% cut in energy use by 2030 below business-as-usual levels.

Efficiency is the fastest and cheapest way to reduce energy consumption, cut down on pollutants and save money at the same time. As many Middle Eastern countries run short of gas, and even turn to imports, more efficient use of resources is also becoming a security issue. And, done well, energy efficiency measures do not mean sweating in the dark – instead, they improve the quality and comfort of homes and offices.

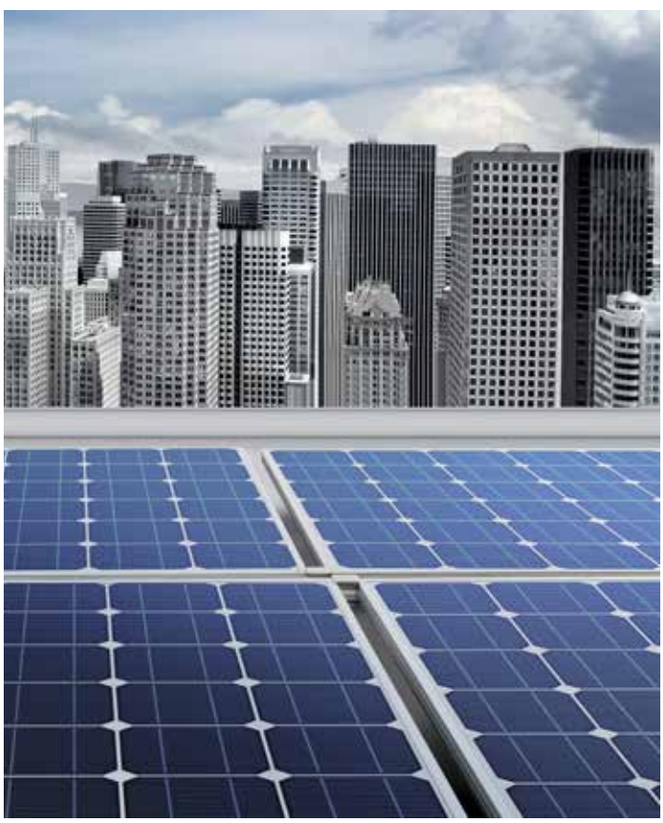
Gulf countries have traditionally been amongst the most energy-intensive economies in the world. In part, this is an understandable consequence of the hot, arid climate which requires air-conditioning and desalinated water. It is also due to their role as provider of oil, gas and energy-intensive products to the world. But in large measure, electricity and water are wasted because of lack of awareness, outdated equipment and low prices.

> “The city’s robust growth means that overall consumption will grow, but electricity use per person fell by around 6 per cent.”

Dubai is driving improvements by tightening building standards, highlighting best practices, using government premises for case studies, and increasing electricity and water prices. In 2008, tariffs were raised, with higher rates for heavy consumers. From January last year, tariffs went up again, and a surcharge was introduced to cover the cost of expensive imported liquefied natural gas (LNG) fuel.

Particular initiatives have included campaigns by Dubai Electricity and Water Authority (DEWA) to raise awareness of energy efficiency; distribution of 800,000 low-energy bulbs by the Dubai Carbon Centre of Excellence, making solar water heaters mandatory for all new buildings, and enforcing the green building code for all construction from next year. Nearly all treated sewage is used for irrigation of landscaping. At federal level, the UAE has enforced efficiency standards on appliances and restricted the import of inefficient air-conditioners.

Dubai Aluminium (Dubal), the Emirate’s single-largest energy consumer, has made strenuous efforts to increase efficiency with new furnaces, regenerative burners, evaporative cooling, co-generation and other technical improvements.



Regulations are being developed for Energy Service Companies to bring in specialist expertise and financing. One of the key experiences learned from energy efficiency programmes around the world is that they are economically-attractive yet difficult to implement. Efficiency gains consist of many small measures which take patience and expertise to identify and implement; a task beyond overworked householders and building managers. Landlords may worry that improvements will not improve the rental price of their property. There may not be the financial capital for improvements, especially in companies that go for equipment with the cheapest up-front costs, instead of equipment with the most economic life-time operations.

These measures are showing results. The city’s robust growth means that overall consumption will grow, but electricity use per person fell by around 6 %. This enabled Dubai to delay construction of its large planned 1.6GW Hassyan power plant.

Businesses are responding, recognising that energy savings can cut their costs, build a positive reputation and develop new business lines.

In June, The Change Initiative building in Al Quoz achieved the world’s highest LEED Platinum rating, 107 points out of a maximum 110. It features solar power, ultra-efficient LED lights, automatic curtains and advanced insulation.

In the same area, the new DEWA office is also LEED Platinum-rated and the largest government building in the world to be so; with highly efficient water-cooled air conditioning, Energy Star office equipment, extensive ambient daylight, solar panels and a wind turbine. It saves 66 % of electricity and 48 %of water compared to a standard building.

Dubai also recognises the potential to sustain its tourism-friendly brand and develop the wider economy. As the region’s finance and service hub, it is the ideal location for companies specialising in energy efficiency, such as Pacific Controls, a developer of automation systems for buildings. Their headquarters became in 2007 the Middle East’s first LEED-certified platinum rated building.

Achieving the goal of a 30% reduction will not be easy. With a large transient population, it is difficult to introduce and maintain good habits of responsible energy use. Many users are not metered individually, or their bills are paid by the landlord or employer. Current buildings, with glass facades and insufficient insulation, were not built with efficiency in mind and will be expensive to retro-fit.

But these challenges, and the hot and arid climate, are common to all Gulf countries. Dubai is taking an important lead to demonstrate that cities in this region can be efficient and sustainable, and is testing the best ways to achieve this.

ABOUT ROBIN MILLS

Robin is Head of Consulting at Manaar Energy, and author of The Myth of the Oil Crisis and Capturing Carbon. Contact Robin on robin@oilcrisismyth.com or follow him on Twitter @robinenergy.

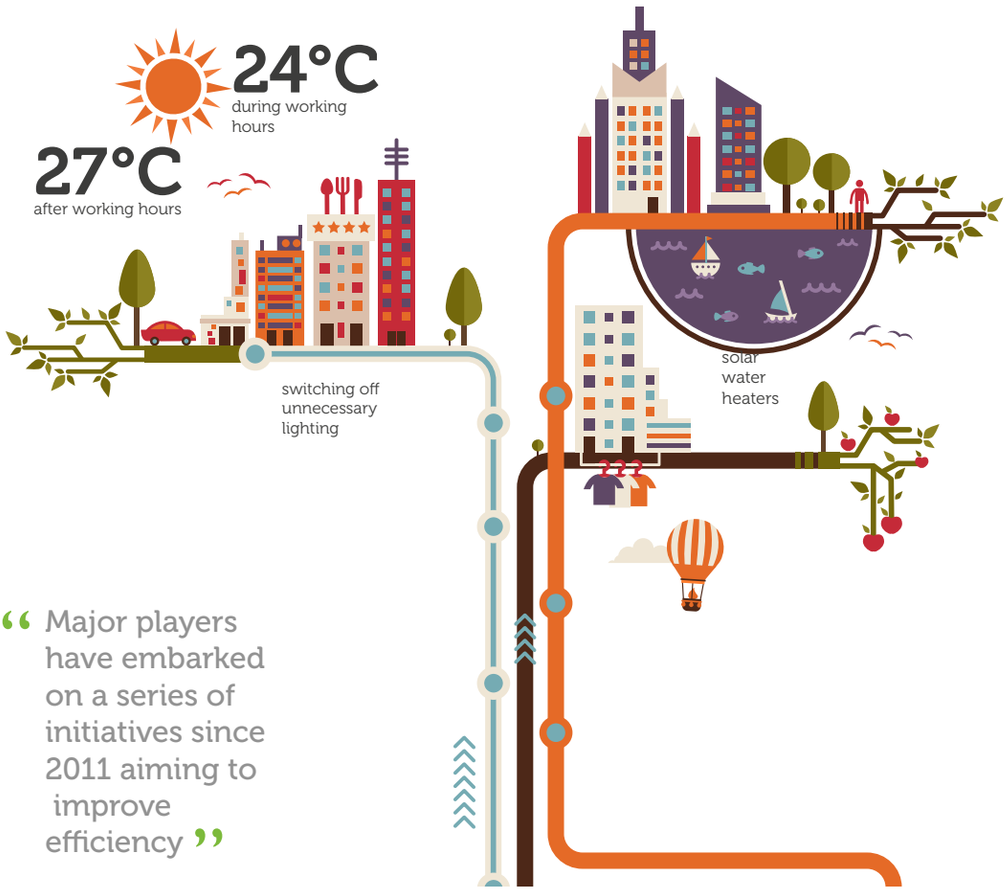
A LARGE LEAP TOWARDS ENERGY EFFICIENCY

Dubai Government sets its thermostats at 24 degrees and therefore the pace in the race to consume less.

Improved energy efficiency across Dubai's economy is a pre-requisite for successful implementation of the Dubai Integrated Energy Strategy 2030. This objective is also embedded in the Dubai Strategic Plan 2015 for 'Government Excellence'. The Government of Dubai is committed to drive this effort and serve as an example for Dubai, both regionally and globally. It adds to Dubai's efforts to strengthen its position as a Global Business Hub and as a Centre of Sustainable and Clean Energy Development.

Dubai Supreme Council of Energy steers all these effort by promoting practical initiatives and best practice that are conducive towards better energy management and sets the bar for others. Considerable measures have been implemented by the member companies of the Supreme Council of Energy, as well as the organisations of the Government of Dubai. The Dubai Carbon Centre of Excellence manages activities to drive Dubai in energy efficiency and carbon dioxide emission reduction.

The Supreme Council of Energy's member companies are Dubai's major energy players: Dubai Electricity and Water Authority, Dubai Aluminium (DUBAL), Dubai Municipality, ENOC, Dubai Petroleum and the Dubai Supply Authority have embarked on a series of initiatives since 2011, to improve efficiency in their operations.



> "Major players have embarked on a series of initiatives since 2011 aiming to improve efficiency"

These include:

- Reducing DEWA's line losses from 6.3% in 2001 to 3.5% in 2011
- Reducing operation costs of DEWA's electricity and water generation units.
- Reducing natural gas use in DUSUP's operations
- Reducing electricity and water consumption in DPE complex (10-15% target in 2012);
- Optimising electricity and water use in Dubai Municipality's operations, such as the operation of public fountains and parks and the use of solar lighting
- Optimising usage of recycled water for irrigation purposes and other uses
- Optimising natural gas use and water production in DUBAL (DX technology, GTX cogeneration efficiency and synergies with DEWA)

The Impact

The power of simple, cost-effective measures in saving electricity can be seen through four quick-win measures implemented by the member companies of the Supreme Council of Energy: setting the thermostat at 24C during the day and 27C outside peak hours, switching off lights when not needed, and replacing inefficient-lighting and using solar water heaters. By implementing these quick-wins, the member companies of the Supreme Council of Energy have reported savings of more than 40GWh in 2012.

The Supreme Council of Energy works closely with 40 organisations from the Government of Dubai to promote the implementation of similar measures, along with the use of water-efficient practices and appliances. The objective is to reduce electricity and water consumption in government services and to achieve tangible benefits in terms of resource efficiency and reduction of the Government of Dubai's carbon footprint. These efforts, based on increasing the energy management capabilities of administration and facilities managers, have already brought real results. In 2012, for the first time, the total electricity and water consumption in the government category of DEWA customers was reduced by 30 GWh and 306 million imperial gallons per day, respectively.

To encourage engagement with the private sector and promote the reduction of their carbon footprint and reducing emissions in Dubai, the Supreme Council of Energy has mandated that Dubai Carbon manages and encourages these measures to reduce carbon dioxide emissions.

Dubai is committed to its reputation of excellence; therefore leading by example will continue to feature high among its priorities on its energy efficiency agenda.

ABOUT FAISAL RASHID

Faisal is Senior Project Manager Demand Management for the Dubai Supreme Council of Energy.

WHICH EUROPEAN ESCO BEST PRACTICES COULD BE REPLICATED IN THE UAE?

Dubai has defined an ambitious Demand Side Management plan and to support this, there are many best practices from other parts of the world that can be replicated in the UAE.

Looking specifically at Europe, the climate and energy package is a set of binding legislation that has been enacted and which aims to ensure the European Union meets its ambitious climate and energy targets for 2020. These targets, known as the '20-20-20' targets, set three key objectives for 2020:

- 20% reduction in EU greenhouse gas emissions from 1990 levels;
- Raising the share of EU energy consumption produced from renewable resources to 20%
- 20% improvement in the EU's energy efficiency

The target to improve energy efficiency by 20% has pushed certain European countries to develop specific strategies to reduce the energy consumption of buildings that consume a large portion of Europe's energy. In response to the increased demand, the role of energy services companies (ESCOs) has increased and they are seen as one of several critical vehicles to help achieve energy reduction; thanks to the energy demand reduction projects they can realise. For example, in Belgium, the federal government has set up a specific organisation, named Fedesco whose objective is to improve energy efficiency of all federal buildings in the country. In the UK, the Mayor of London has created a program named 'RE: FIT' that is driving the creation of projects that improve the energy efficiency of public buildings of London through the use of Energy Performance Contracting (EPC) and ESCOs. Both organisations have been active in recent years and the results are showing: buildings have been upgraded, the energy footprint has been reduced and, due to the use of Energy Performance Contracting, the savings are guaranteed by the ESCOs.

In other European countries such as Germany or Austria, the energy agencies play a key role to ensure that public buildings owners are being assisted to create energy efficiency projects in buildings. Laws in certain regions of Germany have been set in such a way that when a building needs renovation, Energy Performance Contracting must be a primary consideration prior to project commencement. This approach has resulted in many needed upgrades and energy efficiency retrofits.

As the UAE is a growing nation, these best practices can be replicated and adapted to the local environment. The recent creation of Etihad ESCO to organise energy efficiency projects for the UAE buildings is just the first example.

ABOUT STEPHANE LE GENTIL

Stephane is Chief Executive Officer for Etihad Energy Services, the newly formed Super ESCO which is a fully owned subsidiary of Dubai Electricity and Water Authority (DEWA). He previously served as Chairman of eu.ESCO, the European association of Energy Service Companies and worked for Johnson Controls in Europe to build their ESCO business.

THE UTILITY THAT WANTS TO SELL LESS ENERGY

The paradox of DEWA convincing customers to reduce their electricity and water consumption in support of the Emirate's vision

The all-encompassing Dubai Integrated Energy Strategy 2030 incorporates demand-side management as a necessary element in streamlining the Emirate's energy performance. The utility supplying the Emirate, Dubai Electricity and Water Authority (DEWA), is in favour of selling less electricity and water to its customers. This begs the question – why?

The answer to this lies in the unique make-up of Dubai's economy. Whilst the private sector in other parts of the world often actively opposes such legislation, Dubai has the advantage of its utility being a government organisation, which acts in unison with the Government of Dubai to achieve the unified vision for the Emirate to have a sustainable economy. The MD and CEO of DEWA, HE Saeed Mohammed Al Tayer, is Vice-Chairman of the Dubai Supreme Council of Energy, the government body responsible for the oversight and strategy of the energy sector in Dubai and the initiator of the Dubai Integrated Energy Strategy. Al Tayer, and many other executives in charge of key industries of the emirate that are member companies of the Supreme Council of Energy, are working together to ensure that the vision of Dubai's leadership is translated into action. Furthermore, taking into consideration the forecast for Dubai's rapid economic development, a reduced demand upon 'business as usual' means that generation capacities can be allocated more efficiently without the need for many new power stations, and further reduces peak demand. All the while, this maintains Dubai's reputation and attractiveness as a growing economy.

So DEWA has good reason to be committed to this potential future. DEWA has been implementing demand-side best practices for several years, collecting information on current consumption and charting ways to decrease demand through awareness campaigns for end-users and investments in efficient technologies. In 2011, DEWA succeeded in reducing power-demand growth considerably to only 3% net consumption growth: down from the 6% expected gross consumption growth despite a simultaneous 5% growth in registered combined electricity and water accounts. This reduction in consumption growth was achieved due to the implementation of best practices in power demand management, using the latest technologies and implementing a slab tariff to encourage consumption conservation as a major means of reducing waste.

DEWA is working with consumers, by conducting energy audits for different

customers and promoting efficient technologies and housekeeping measures for lighting, air conditioning and water. DEWA has also conducted a series of awareness campaigns in different media, themed events; these include Earth Hour, Environment Day and Earth Day, and produced conservation leaflets, brochures, and awards to further encourage the rationalisation of electricity and water consumption by Dubai's inhabitants.

DEWA believes in behaviour-based energy efficiency, so customers can see their historical consumption patterns and compare them to those of their neighbours. Since June 2013, DEWA included carbon dioxide emissions equivalent to customers' electricity consumption to raise awareness of the impact of climate change. DEWA has also constructed a slab tariff system that provides an economic incentive to reduce electricity and water consumption.

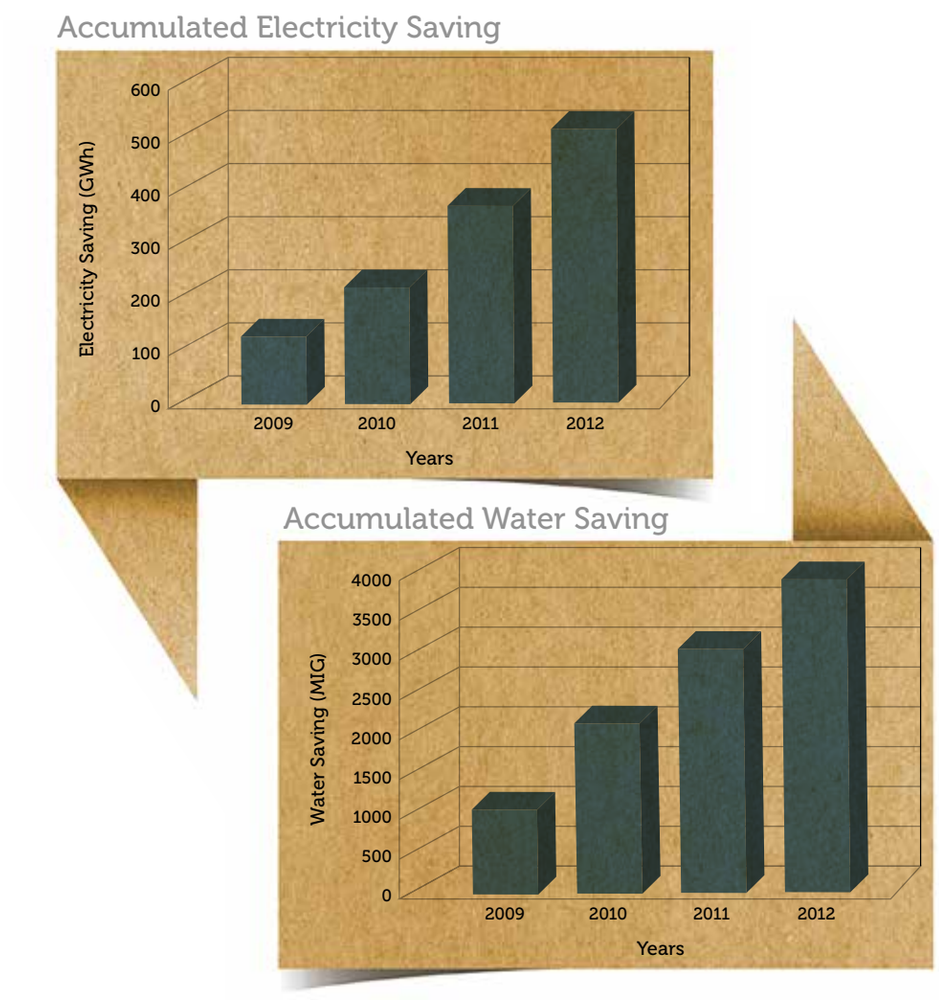
DEWA is working on improving its own operations to maximise the efficiency with which it produces energy. The utility has decreased its grid power losses from 7.03% in 1998 to 3.5% in both 2011 and 2012, by following the best international technical standards and engineering practices in power system planning, design, construction and operations. Similarly, DEWA succeeded in reducing the Unaccounted for Water in the water supply system from 42% in 1988 to 10.88% in year 2012.

DEWA managed to raise the efficiency of its existing generation plants by 26% between 2006 and 2012. Its production capacity has been increased by 450MW by using proven technologies at a small cost when compared with installing new generating units of a similar capacity.

DEWA assisted in the shifting process of existing district cooling plants to use Treated Sewage Effluent water instead of desalinated water. During a large-scale project in 2012, inefficient lights were replaced in DEWA premises and offices, and also in external lighting of substations and generation premises. DEWA is now proceeding with retrofitting its office buildings to rationalise electricity and water consumption. In addition, to set an example, DEWA has a constructed sustainable building in Al Quoz; the largest public sector building in the world to successfully integrate and implement many sustainability features, achieving a high-performance green-building rating and awarded the Leadership in Energy and Environmental Design LEED® Platinum certification, having scored 98 out of a possible 110 points.

Nonetheless, the Dubai Integrated Energy Strategy (DIES 2030) has set the demand reduction target at 30% for 2030. Therefore DEWA is playing a central role in the implementation of the roadmap and action plan to achieve this challenging target.

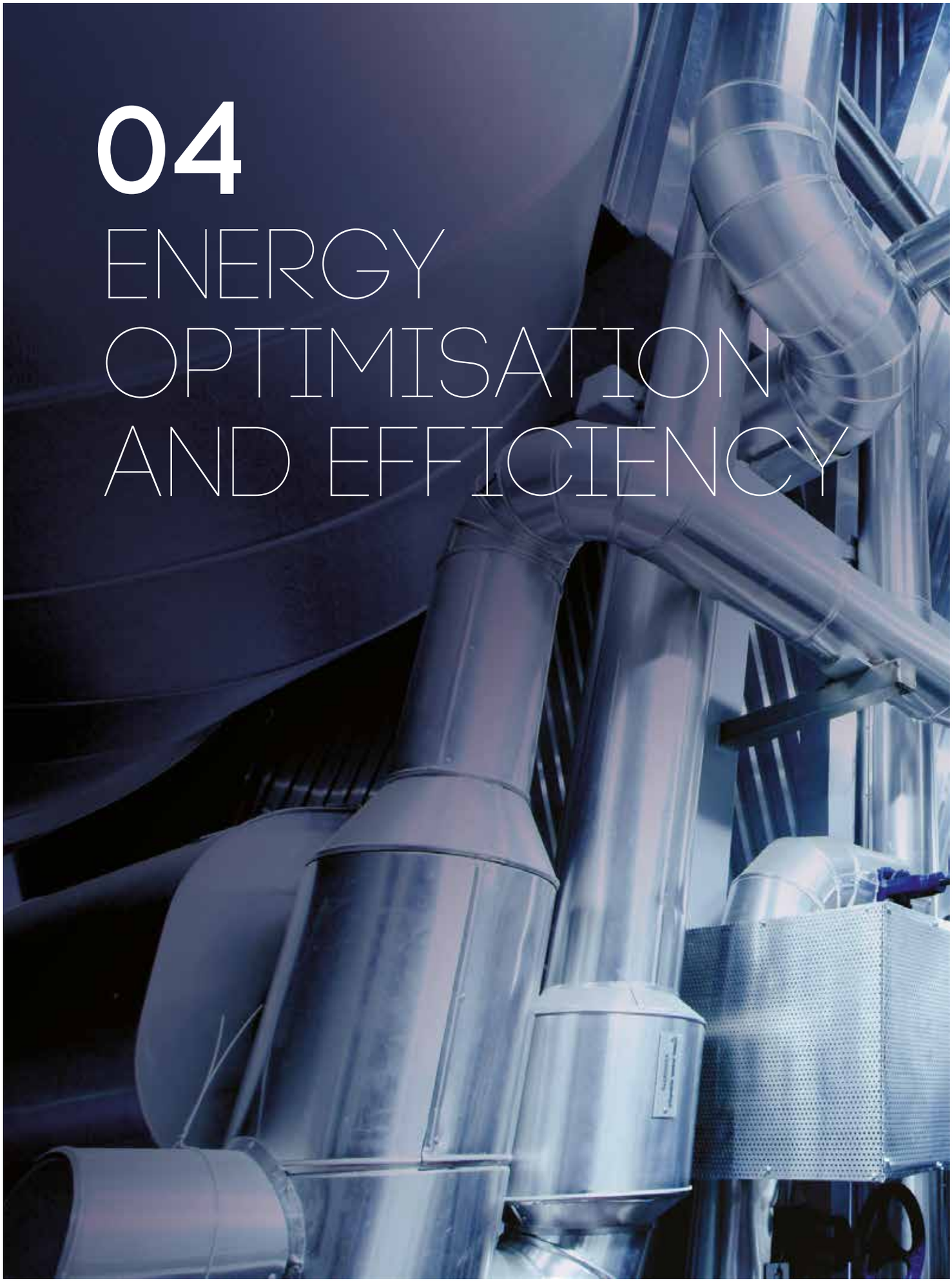
Combined Effect of Awareness & Audits



> "DEWA succeeded in reducing power-demand growth considerably to only 3% net consumption growth"

ABOUT YOUSEF JEBRIL

In his current role he is Executive Vice President for Power and Water Planning at the Dubai Electricity and Water Authority. He holds around 33 years of varied hands-on experience; with utilities and consultants, in Power Generation, Power Transmission & Distribution Systems.



04
ENERGY OPTIMISATION AND EFFICIENCY

My desire is that the UAE has the most energy-efficient economy in the region. This is essential for global competitiveness, as improved efficiency is part of a holistic approach to the wider economy.

I am very proud that energy-efficiency is encouraged by Dubai and the UAE. At DUBAL, it is integral to our corporate culture and a senior executive is responsible for implementing our energy policy. DUBAL representatives work closely with the Dubai Supreme Council of Energy (DSCE), of which we are a member entity, and the DSCE's objectives are incorporated in our future policy framework. Moreover, DUBAL pro-actively supports the DSCE's initiatives to implement the Dubai Integrated Energy Strategy (DIES) 2030 – including the HH Sheikh Mohammed Solar Park; the clean coal power plant study; demand and supply-side management; and much more.

I believe that energy-efficiency should be the call of choice when it is the cheapest option. This underscores my personal commitment that this be reflected in the new architecture of the global electricity market. As part of our commitment to best practice, the DUBAL Power Station has already achieved tremendous efficiency improvements recent years, despite continuous expansion in our hot metal production capacity.

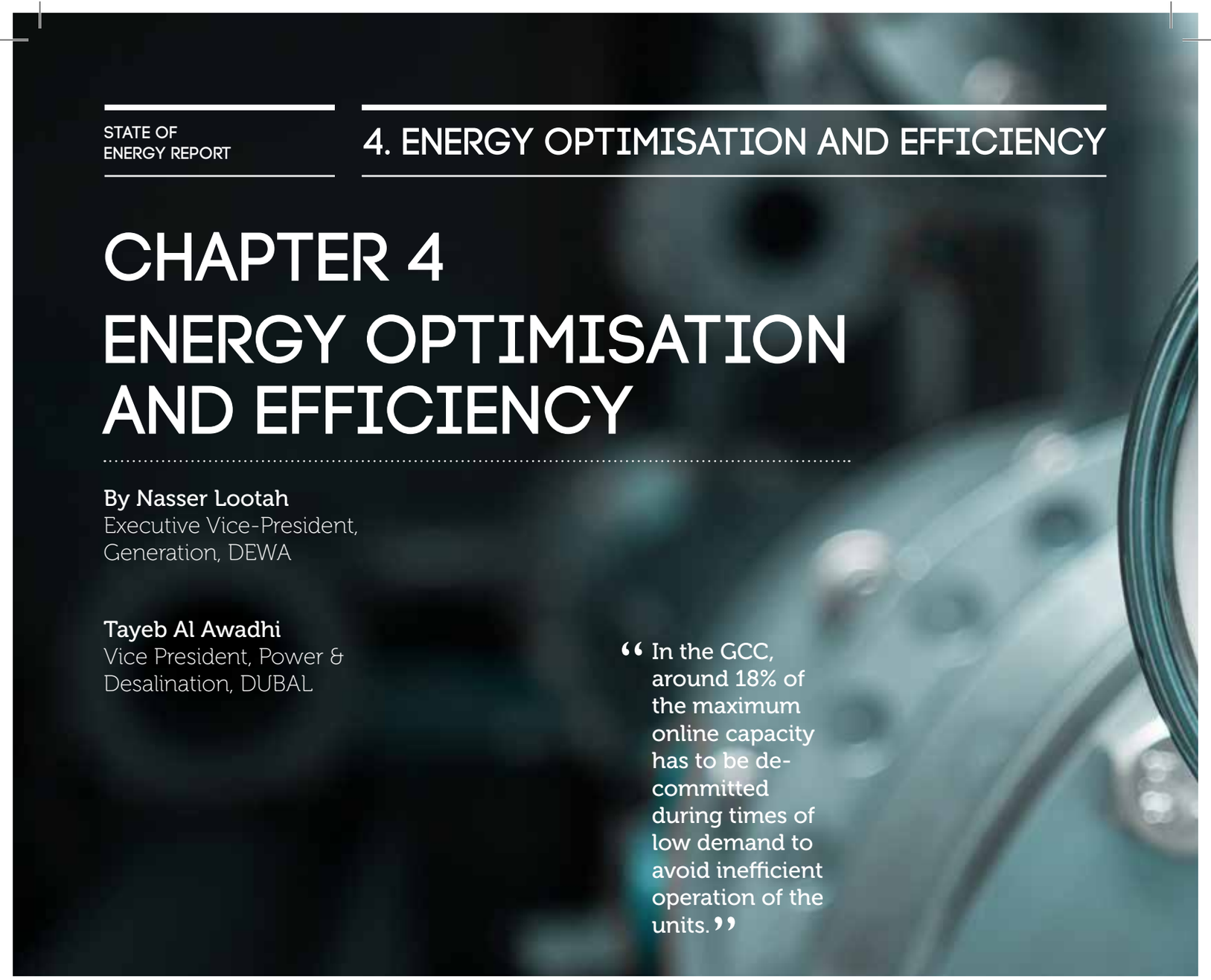
ABDULLA JASSIM KALBAN

CEO & President, Dubal

CHAPTER 4
ENERGY OPTIMISATION AND EFFICIENCY

By Nasser Lootah
Executive Vice-President,
Generation, DEWA

Tayeb Al Awadhi
Vice President, Power &
Desalination, DUBAL



> "In the GCC, around 18% of the maximum online capacity has to be de-committed during times of low demand to avoid inefficient operation of the units."

COOL THE ENGINES

DEWA and DUBAL with installed power capacities of over 9,646 megawatts (MW) and 2,350MW, respectively, have managed to increase the output in accordance with Dubai's rapid growth due to constant process optimisation.

For the past decade, Dubai has witnessed double-digit growth in the demand for power and water. Generating these utilities as efficiently as possible has become a priority and a number of approaches have been used by the Dubai Electricity and Water Authority (DEWA) and aluminium producer Dubai Aluminium (DUBAL), the two entities in the Emirate that produce water and power on a large scale.
Ensuring that new facilities are designed and operated efficiently, as well as improving existing facilities and introducing new technologies has enabled the two organisations to realise substantial savings of energy – and water, which not only improves their financial performance but also their environmental record.

DEWA produces electricity and water for the Emirate of Dubai mostly by co-generation; a process in which waste heat from the burning of natural gas to produce electricity is captured and used to heat water for the desalination process. In 2012, DEWA had 9,646MW of installed power capacity and water capacity of 470 million imperial gallons of water per day (MIGD).

Power augmentation technologies have helped DEWA boost energy efficiency; 322MW capacity enhancement at 18% of the cost of conventional plant and 62% fuel-free. Between 2006 and 2012, the authority achieved an efficiency improvement of 26% through an optimum power plant design, optimum operations and maintenance and power augmentation.
Achieving optimum power plant design is the first step towards efficient operation. For DEWA, deciding on the optimum design depends on the power to water requirements. For some systems, the optimum design is co-generation plants with back pressure steam turbines and design fuel utilisation of 84% to 90%. For other systems, using condensing extraction steam turbines, with lower utilisation, is a better option.

> “A key factor contributing to efficiency is how equipment is operated during summer.”

In general, the optimum power and water production design is achieved in a hybrid system where water production is shared between several technologies – multi-stage flashing or multi-effect desalination and reverse osmosis.

Besides optimum design, another important step is achieving optimised operation where units are committed and de-committed to meet the required power and water demand, with minimum fuel cost and associated environmental impact, while maintaining system security and reliability. In the GCC around 18% of the maximum online capacity has to be de-committed during times of low demand to avoid inefficient operation of the units. In DEWA, cyclic operation of units is completed on the basis of less efficient units being shut down first in order to permit operation of the remaining units at higher loads and improved efficiency.

Also important is optimum outage planning - a management tool that coordinates all maintenance outage requests, taking into consideration both reactive and proactive approaches. Its objectives are optimising maintenance programmes to permit outage requirements and meet system demand with the highest efficiency and minimum fuel cost, as well as implementing commissioning activities with minimum impact on the network and maximum utilisation of assets.

A key factor contributing to efficiency is how equipment is operated during summer, when high ambient air temperatures are recorded on a daily basis. For example, at 45°C, gas turbine power reduction is typically around 20% compared to the ISO rating. The increase in ambient temperature reduces air density and consequently the airflow to the gas turbine compressor decreases. This means that plants in the Gulf region face loss of capacity and efficiency when it is needed most.

Recovery of power loss and efficiency is possible using several cost-effective and proven power augmentation options. These can be categorised as ambient dependent, which includes evaporative cooling and fogging and also non-ambient dependent; this includes wet compression and gas turbine inlet air chilling.

Evaporative cooling increases efficiency by lowering the temperature of air supplied to compressors. Soaked pads or continuously-moistened ‘evaporating media’ panels are installed downstream from the gas turbine air-intake filter house. As the (relatively) dry air passes across, the water evaporates and air temperature drops.

4. ENERGY OPTIMISATION AND EFFICIENCY

> “Another example of DUBAL’s commitment to minimising energy consumption is the innovative pilot energy-saving absorption chiller project built on the rooftop of the DUBAL Desalination Plant Control Building.”

The actual air temperature drop is a function of both the equipment design and atmospheric conditions, especially the relative humidity – the performance of evaporative cooling is drastically reduced at high relative humidity. The advantage of using evaporative cooling is its low initial capital cost. However, this is threatened by performance uncertainty. The constant control of make-up water quality, and ‘blow-down’ (alongside a number of other issues) have to be addressed during the design stage of the system to ensure straightforward operations.

Fogging systems were originally designed and used for interior climate control of residential and office areas and have recently been introduced for gas turbine inlet air-cooling. Although using the same principle of water evaporation, a fogging system is not a passive system (like evaporative cooling), but is an active spraying system. It injects finely atomised water droplets within the large evaporative surface area of the inlet air on the path towards the gas turbine compressor.

The saturation efficiency of inlet fogging systems is better than that of evaporative coolers. However, the former require particular attention to avoid excessive water carry-over to the compressor and minimise possible difficulties due to the impact of droplets on the compressor blades and vanes. High-purity demineralised water must be used to minimise the risk of compressor fouling and, therefore, it is necessary to use high-grade stainless steel for all moistened parts. It is also necessary to apply protective coatings on non-stainless steel inlet duct surfaces to avoid corrosion.

Drainage of water from air inlet ducting is an important issue that needs to be addressed during the design phase. Another issue is the control system for fogging and its interlock with the gas turbine control system.

When it comes to retrofitting existing gas turbines, fogging systems have lower investment cost and faster installation time than evaporative cooling systems. However, the consumption of demineralised water and increased auxiliary consumption for high-pressure pumps also has to be considered when calculating operation costs.

The proven non-ambient dependent power augmentation technologies are wet compression and Thermal Energy Storage Turbine Inlet Air Chilling (TESTIAC). Both offer energy-savings that can be achieved at a fraction of the cost of a conventional plant.

Wet compression improves efficiency by 7%; it increases capacity by 12% to 15% and reduces NOx emission by 20% to 40%. It is accomplished by injecting (into the inlet air stream) a larger quantity of water than can be evaporated at the given ambient conditions. It enhances the overall performance of a gas turbine through several mechanisms; one is partial evaporative cooling effect that occurs when the ambient relative humidity is lower than 100%, as some of the water evaporates before entering the compressor.

In addition, as the air stream carries non-evaporated water droplets into the compressor section, the higher temperatures in the compressor increase the moisture-holding capacity of air and consequently the water droplets evaporate rapidly in the front stages of the compressor, thereby inter-cooling the air during compression. Inter-cooling lowers the temperature of

> “The year average gain from the DUBAL Evaporative Cooling system is a 5% increase in electrical output and 1.5% improvement in heat rate.”

air during the compression process, thus reducing the amount of compression required.
The total mass flow through the turbine is increased by the significant quantities of water injected into the compressor, and the additional amount of fuel is used to raise the temperature of combustion - in order to maintain the design turbine inlet temperature. This way, the turbine produces more power, and the power output and efficiency increase further.

As the gas turbine power output and efficiency gains depend mainly on the water injection flow rate, wet compression is effective even at high ambient relative humidity. This makes it one of the preferred solutions for coastal area projects in the region. The substantial reduction of NOx emissions is another favourable effect; this is attributed to increased flue gas thermal heat capacity from the water and decreased compressor discharge temperatures.

Since water is injected into the compressor, there is a potential risk of compressor blade erosion and wear due to droplet impact. Not all compressors are designed the same, and wear and erosion rates may differ depending on the gas turbine model. Installing wet compression requires certain turbine upgrades that depend on the turbine model and generation.
The investment costs of installing such systems are justified by the significant power output increase and efficiency improvements that are insensitive to ambient conditions.

TESTIAC improves efficiency by 7%, increases capacity by 12%, and reduces NOx emissions by 7% to 10%. It involves using chilled water circulating through tubular heat exchangers installed in the air intake filter house.

The chilling of inlet air is able to bring inlet air conditions close to, and even lower than, the ISO design specifications and is insensitive to ambient humidity. Chilled water must be produced in a separate chilling plant where various design criteria must be addressed in order to optimise the final performance. This includes the type of compressors and refrigerant, and also the modality of effective heat rejection.

Eventual use of thermal energy storage is an option, in addition to the chilling plant and installing cooling coils in the gas turbine filter house. Based on the ambient air profile during summer months, use of TESTIAC (which incorporates a chilled water storage tank) can be an optimised solution. As the chilled water generation is done during ‘off peak’ hours, it reduces the chiller’s capacity by as much as 50%, compared to a direct cooling system. In addition, the electric power consumed by chillers does not influence power output of the gas turbine during peak hours.

Of all the previously-discussed technologies, this has the highest capital cost. However, it offers a well-defined, flexible and reliable power augmentation system, which also ensures reductions in NOx emissions, due to the lower temperatures of inlet air in the combustion chamber. The adverse impact, if any, on the performance of the gas turbine is minimal, as it emulates ambient conditions close to the ISO specifications for which the unit is originally designed. Theoretically, there is no need for upgrade of the turbine parts or its auxiliaries, although a check of the BOP features (to support the increased power output) is mandatory for this solution, as it is for any other option.

The industrial flagship of the UAE, DUBAL, produces more than one million tonnes of molten metal per year. Built on a 475-hectare site in Jebel Ali, and producing more than one million tonnes of molten metal per year, it operates the largest single-site aluminium smelter in the Middle East; and the largest in the world using pre-bake anode technology. The DUBAL smelter complex is also home to a captive power station (2,350MW at 30˚C) and a seawater desalination plant (30MIGD).

Since its inception in 1979, DUBAL has been committed to innovation in the aluminium smelting process, while achieving maximum operating efficiencies. Substantial resources have been invested over the years in process improvements that not only increase productivity, but also reduce the impact of the smelter operations on the environment – with specific emphasis on optimised water and energy consumption; and minimised air emission levels.

4. ENERGY OPTIMISATION AND EFFICIENCY

> “DUBAL achieved another regional ‘first’ recently, by receiving the ISO 50001 Energy Management System (‘EnMS’) certification for the DUBAL Power and Desalination Plant.”

DUBAL continuously upgrades and enhances its gas turbine fleet to achieve better energy-efficiency. The pace of change has accelerated in recent years, resulting in a complete upgrade of the company’s six Frame9E gas turbines and five Frame9BE rehabilitation project.

The DUBAL Power Plant also relies on an evaporative cooling system for enhanced efficiency. The system was initiated in 2006 when a single gas turbine was fitted with the technology. Between 2008 and 2010, evaporative cooling was installed on a further eight turbines. As a result, the large gas turbines in the DUBAL Power Plant operate at cool ambient temperatures throughout the year, even in peak summer conditions. Previous experience shows that a one-degree increase in ambient temperature reduces the electrical output of the gas turbine combined cycle unit by 1MW. However, with the installation of evaporative coolers, DUBAL has been able to reduce the ambient temperature of the air inlet to the compressors by an average of 5°C to 10°C.

An evaporative cooling system is a useful power augmentation project where water is sprayed behind the air filtration media and evaporates by absorbing latent heat from the incoming hot air, which results in the air cooling down by giving up sensible heat. In practice, this process increases the air density, which allows higher mass flow into the gas turbine inlet, thereby increasing the turbine electrical output and thermal efficiency. The annual average gain is a 5% increase in electrical output and 1.5% improvement in heat rate.

In 2011, DUBAL completed the construction of its technically challenging GTX cogeneration plant. In each of the GTX cogeneration plant’s three operating regimes, the overall plant efficiency has improved and fuel consumption has been reduced. The project involved the installation of limited new facilities as well as availing the spare capacity of the existing installation, thus increasing the flexibility of the existing systems. The new installation ensured the utilisation of additional steam turbine capacities as well as flexibility of operation - between power mode, with more electricity produced, and water mode, with more water produced.

The concept required the installation of an extremely-complex steam distribution network, which could be directed to the different steam turbines. As a result of the project, station efficiency improved from 43% to 45%. Gas consumption was reduced by 13 mscfd to 20 mscfd (depending on mode of operation), with 270,000 to 400,000 tonnes of CO2 emissions saved, (depending on mode of operation), as well as reducing NOx emissions by 1,800 tonnes.

Another example of DUBAL’s commitment to minimising energy consumption is the innovative pilot energy-saving absorption chiller project, built on the rooftop of the DUBAL Desalination Plant Control Building. This installation is the UAE’s first ever absorption chiller using waste heat, and is the first such application in a power plant. A minimal volume of the steam produced by the captive cogeneration and combined cycle DUBAL Power Station is used (about 0.6 tonnes of steam per hour); and the absorption chiller process uses just 40% of the electricity consumed by the conventional electrically-driven chillers to produce sufficient cooling for the same purpose. This means that the absorption chiller could reduce DUBAL’s energy consumption by approximately 626,800 kWh per year, equating to a reduction in CO2 generation by about 300 tonnes per year.

DUBAL maintains high generation availability and efficiency by operating its most efficient combined cycle machines. Its 13E2 MXL machines are preferred as they support the power station operating strategy. When DUBAL carried out the first C inspection of its 13E2 MXL machine, the planned completion schedule was 42 days. By ordering a Turbine Vanes Carrier and Combustion Chamber in advance, the outage plan was reduced to 36 days. This was further reduced to 33 days by carefully managing the entire outage plan from preparation, execution to commissioning. Based on the experience gained in the first machine, the outage for the second machine was further reduced to 28 days. This resulted in savings in excess of USD 800,000. DUBAL reduced this even further still, to 23 days, when the next machine which was due for C Inspection.

Acknowledging the energy-intensive nature of the smelting process, DUBAL, since inception, has continuously striven to be a role model in terms of reducing kWh/kg of aluminium production. Through extensive research, the DUBAL Technology Development department has developed proprietary high amperage reduction cell technology that operates at benchmark specific energy levels. The 40 DX Technology cells at DUBAL consume less than 13.2 kWh/kg aluminium (at 385 kA); while the five pilot DX+ Technology cells at DUBAL consume less than 13.33 kWh/kg aluminium (at 420 kA). DX Technology has been installed in the 756-cell Emirates Aluminium ('EMAL') Phase I; and DX+ Technology has been licensed to EMAL Phase II (444 cells, currently under commissioning).

DUBAL achieved another regional 'first' recently, by receiving the ISO 50001 Energy Management System ('EnMS') certification for the DUBAL Power and Desalination Plant. Developed in 2011, ISO 50001 provides guidelines for energy management with the emphasis on establishing, implementing, maintaining and improving existing energy management systems – thus helping to continuously improve and manage an organisation's energy utilisation, performance and consumption levels.

Several initiatives attest to the high standards met by the DUBAL Power Plant's existing EnMS, which is consistently supported by significant investments to save energy and maximise the use of available fuel to maximise hot metal production. The enhanced efficiency of DUBAL's smelter and power operations over the period 2005 to 2012 reduced the total fuel consumption by 14 mscfd, and the corporation's CO2 emissions have been reduced by 270,000 tonnes/year.

The previously-mentioned projects under DEWA and DUBAL are interesting examples of energy efficiency for other power and water producers in the region. There are many lessons to be learned, including the need to consider power augmentations at the design stage of power stations. It is also important to have full knowledge of the local climate before the selection and design of upgrade technology.

On the technical side, gas turbines and BOP should be suitable for the upgrade and power gain. The air intake structure should have sufficient strength capacity to bear the additional load of new equipment. The intake duct design should be suitable to handle the formation of condensate as a result of air-cooling both inside and outside the duct. Fogging and wet compression are not suitable for some gas turbines due to concerns over erosion of compressor blades and coating, as well as operational instability.

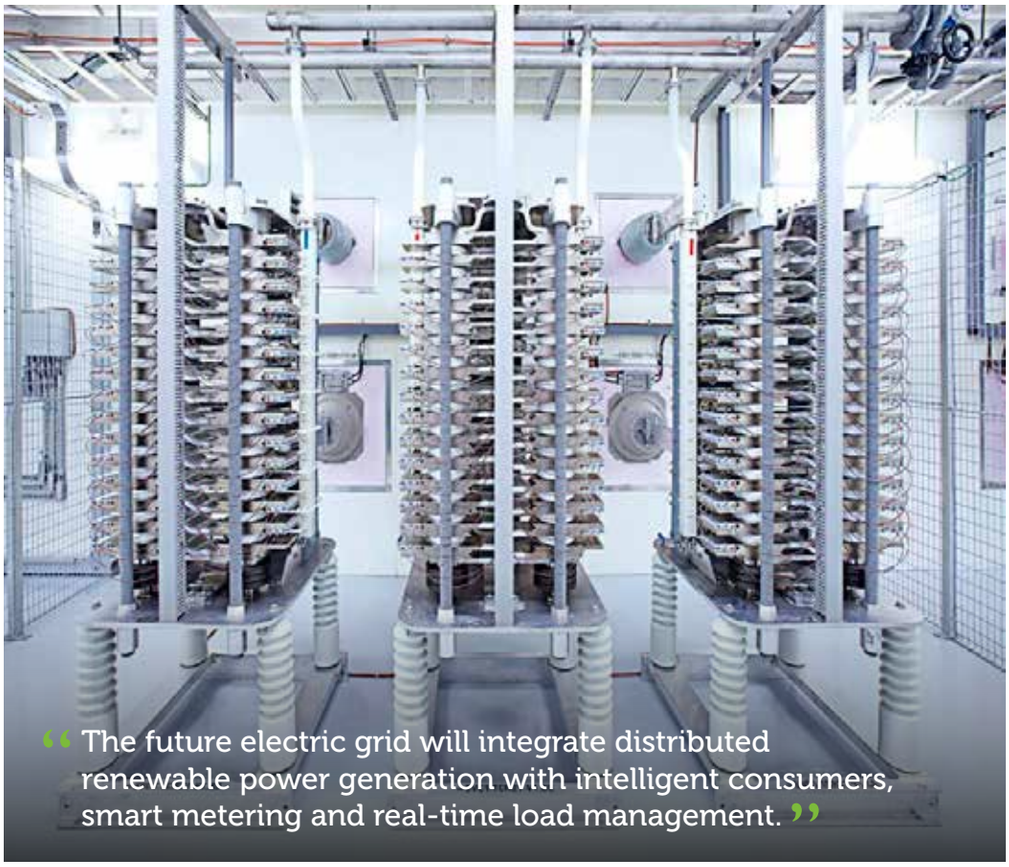
ABOUT NASSER LOOTAH

Nasser Mohammed Hussain Bin Lootah is the Executive Vice President - Generation Division (Power & Water) of DEWA's Power Station (current capacity: 9,646MW and 470MIGD), and is in charge of the Projects & Engineering (Generation) Division at DEWA. He holds a Master's degree in Electrical and Electronics Engineering from Oregon State University.

ABOUT TAYEB AL AWADHI

Tayeb Al Awadhi is Vice President: Power and Desalination at Dubai Aluminium ('DUBAL') (current capacity: 2,350MW and 30MIGD). He joined the company in 1991 and continually strives to improve the availability, reliability and efficiency of DUBAL's combined cycle and co-generation power plants while simultaneously optimising operating costs and minimising the plants' environmental impact. Tayeb holds a Master's Degree (Engineering Science) from University College Dublin, Ireland

THE EVOLUTION OF SMART GRIDS



> “The future electric grid will integrate distributed renewable power generation with intelligent consumers, smart metering and real-time load management.”

ABOUT SAMUEL MERKLI

Samuel Merkli is the ABB business development manager for energy efficiency in the India, Middle East and Africa Region, based in the UAE. Samuel joined ABB in 2009 and holds a double Master’s degree in Business and International Management from the University of St.Gallen and the CEMS alliance of top-ranked European business schools.

There is a call to balance our region’s incremental appetite for power with concerns for the environment and the necessity to bring more renewable energy sources online.

As the world leader in electric transmission and distribution, ABB is pioneering the grid of the future that integrates distributed renewable power generation with intelligent consumers, smart meters and real-time load management.

The traditional grid is under increasing pressure to cope, while transmission system operators must adapt and enhance the flexibility of their grids to improve capacity and accommodate the power markets’ demands. Electrical systems are becoming increasingly intelligent as we enter the era of ‘smart’ technologies. The smart grid integrates information and communication technologies such as smart metering and intelligent supervisory control and data acquisition (SCADA) systems, as well as renewable energy generation, which, until more recently, have not been part of the traditional energy infrastructure.

As the existing power infrastructure ages alongside the surge in demand, it will grow gradually more difficult to ensure the stability of the grid. Demand patterns will also shift, with one cause being the charging of electric vehicles, further changing the shape of the traditional supply/demand patterns. Consumers will be instrumental also, using smart metering systems to monitor their own consumption to avoid using power during peak periods.

While renewable energy sources will help to diversify generation and meet requirements for more power, they will also turn the power network on its head. Breaking away from the past model of a single power station supplying a whole network, the industry will see many generators distributed over a wide area. Therefore, power companies will look to intelligent management of the power grid as the solution.

One case of smart grid technology has been operational at Dubai International Airport since 2004. The international hub’s 11 kV (kilovolt) power distribution network is controlled using a supervisory control and data acquisition (SCADA) system supplied and installed by ABB. As one of the busiest airports in the world - operating 24 hours a day, seven days a week and with the state-of-the-art SCADA system, Dubai Aviation City Corporation is able to maintain an overview of power consumption and supply.

As demand grows and electricity distribution systems become smarter, the SCADA system at Dubai International Airport is just one example of how intelligent control technology will enable utilities to monitor and manage their grids of the future.

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Tayeb Al Awadhi
Vice President: Power & Desalination

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dubal
Dubai Aluminium

CARBON CREDITS FOR DUBAI'S INDUSTRY

"Pursuing CDM registration is a way of getting international recognition and generating additional revenues through the generation of carbon credits."

Industrial Efficiency in the UAE is awarded carbon credits by the United Nations Framework Convention on Climate Change (UNFCCC), which contributes to the projects seeing the light of the day.

> “Initiatives are increasingly being studied to mitigate the issues linked to the uncertainty of fuel cost, energy security, cost reduction...”

In recent years there has been a change of mindset in the power generation and industrial sectors in Dubai (and its neighbouring Emirates). Instead of growth, the focus seems to have switched towards preserving and improving the existing processes through technological upgrades and resource efficiency activities.

The importance of energy efficiency has translated across various spheres, from demand side improvements, to distinct advances in industrial sectors such as aluminium production, cement production, glass production, refineries, manufacturing, and so on. By reducing the need for fossil fuel for power generation, many of these projects also lead to reductions in greenhouse gas (GHG) emissions.

Registering projects under the CDM

When the scale and the project parameters allowed, the project owners also sought recognition of their contribution to sustainable development through registration of the projects under the United Nations Clean Development Mechanism (CDM). Pursuing CDM registration is a way of getting international recognition and generating additional revenues through the generation of carbon credits. In September 2013, the UAE had the second most registered CDM projects in the Arab World (14, only exceeded by Egypt with 17) with 5 of them located in Dubai.

A number of energy efficiency projects in the industrial and power sectors were registered under the carbon credit platform, and were certified as eligible for emission reduction certificates.

Dubai Carbon managed the registration of the Dubai-based projects on behalf of the project owners, leveraging its close collaboration with MDG Carbon, the United Nations Development Programme's (UNDP) corporate carbon finance programme. Together, the five projects are expected over the course of their 10-year CDM crediting periods to reduce a total of 1.3 million tonnes of carbon dioxide, equivalent to approximately 2% of Dubai's annual greenhouse gas emissions.

Exemplary measures

Various energy intensive industries in the region have employed innovative solutions to improve efficiencies, reduce costs, and contribute to sustainable development by lowering emissions of GHG.

Velocity seals

A number of gas processing plants of GASCO in Abu Dhabi achieved significant GHG emission reduction by installing velocity seals in order to reduce the amount of flared gas. This measure decreased GHG emissions by around 8,000 tonnes of CO2e per year since its implementation. (CDM Project Reference: 4508)

Regenerative burners

Another energy efficiency will be generated at the DUBAL aluminium plant in Dubai, where existing cold burner systems on the melting furnaces are to be replaced with regenerative burners. The system will recover waste heat from exhaust gases to preheat the burners and decrease the energy needed for combustion. This installation in three furnaces alone is expected to lead to around 9,800 tonnes of CO2e emission reductions per year. The project has been registered successfully and is scheduled to be implemented soon.
(CDM Project Reference: 7270)

Waste heat recovery

By installing a waste heat recovery system in a cement plant, the facility circumvents the need to produce electricity through traditional fossil fuel-based technologies, leading to considerable GHG reductions. The system works by capturing hot exhaust gases from the preheaters and from the kilns. Steam is generated from the heat and then used to produce clean electricity. The waste heat recovery system installed in Union Cement Plant in Ras Al Khaimah is the first in the UAE and is expected to reduce CO2 emissions by approximately 60,000 tonnes per year.
(CDM Project Reference: 7384)

Cooling inlet air

The installation of an innovative cooling system in a power generation facility cool the inlet air for gas turbines when the ambient temperature is high, thereby increasing the efficiency of the turbines and reducing the need for natural gas. On average, the project will increase the efficiency of the system by 2% and reduce emissions by 27,000 tonnes per year. (CDM Project Reference: 7260)

Looking ahead

There is still a large untapped potential for efficiency improvements in industrial facilities. Overcoming barriers would require greater awareness, external support and more funding for optimising operational efficiency on an industrial scale. These initiatives are increasingly being studied to mitigate the issues linked to the uncertainty of fuel cost, energy security, cost reduction and participation in sustainable development movement in line with the UAE's 'green economy for sustainable development.'

Find details on all projects in the 'Project Design Documents' by entering the project number on http://cdm.unfccc.int. To understand the feasibility to register your large-scale emission reduction projects under CDM, contact Sébastien Aguilar via http://www.dcce.ae

ABOUT SÉBASTIEN AGUILAR

Sébastien is the Technical Manger at Dubai Carbon Centre of Excellence (DCCE). He heads the CDM project registration arm of the business and manages the Greenhouse Gas Inventory and Low Carbon Strategy Development for the centre's clients.

ENERGY- EFFICIENCY THROUGH INNOVATION

By Tayeb Al Awadhi

Breakthrough cogeneration technology has been instrumental in optimising DUBAL's operations

With a generation capacity of 2,350 MW (at 30˚C), the captive power plant at Dubai Aluminium (DUBAL) produces more than enough electricity to cater for its core aluminium smelting business.

Despite this self-sufficiency, the company is committed to energy-efficiency and has adopted the policy of having either combined cycle power plants or co-generation power plants; and, in order to benefit from fuel-free steam turbines, open cycle units have been strictly avoided. Moreover, DUBAL has engaged in many different energy optimisation projects in recent years – some of which have been highlighted below.

> "By interconnecting the new plant with existing combined cycle power plants, an increase in generating output can be achieved on the respective steam turbines, especially during an outage of one of the gas turbines in these blocks."

Unique cogeneration installation

DUBAL's GTX Project entailed the unique construction of a large cogeneration plant, comprising one 13E2-class gas turbine and one heat recovery steam generator (HRSG 23) that produces steam at dual pressure configuration. The GTX Cogeneration Plant runs in cogeneration with three combined cycle blocks, each comprising two gas turbines and one steam turbine. By interconnecting the new plant with these existing combined cycle power plants, an increase in generating output can be achieved on the respective steam turbines, especially during an outage of one of the gas turbines in these blocks. The additional output from the new plant can be supplied to the DUBAL Desalination Plant and used for water production. Unlike conventional combined cycles, the GTX concept involves a very complex steam distribution network, allowing the finished GTX Cogeneration Plant to be operated in one of three modes:

- Add-on Mode – the steam generated by the GTX Cogeneration Plant's HRSG is distributed to the three combined cycle blocks and to the Desalination Plant, so as to utilize the spare capacity of the latter's steam turbines.
- Process Steam Mode – the steam generated by the GTX Cogeneration Plant's HRSG is exported to the DUBAL Desalination Plant.
- Replacement Mode – the GTX Cogeneration Plant fills-in for any of the existing HRSGs in the three combined cycle blocks during periodic maintenance procedures, thus maintaining power generation capacity.

Overall, the installation has enabled an increase in DUBAL's installed power generation capacity, without the need for a cooling water source. It has also improved the power station's power generation efficiency: by integrating the new GTX Cogeneration Plant into the existing DUBAL Power Plant infrastructure, better fuel utilisation has been achieved as evidenced by increased efficiency of electricity generation.

An initial study has shown that the annual average generation efficiency of the DUBAL Power Plant will improve from about 43% to above 45%. This indicates that DUBAL's annual fuel consumption can be reduced by about 3% under gas-firing operations.

Delivering on Dubai Supreme Council of Energy directives

As a member of the Supreme Council of Energy , DUBAL has adopted the directives regarding the measures which the Dubai Government is taking to minimise energy consumption in Dubai, in fulfillment of the DIES 2030. Through implementing the mandated directives, which were issued in April 2011, DUBAL had achieved energy savings of 17,375,316 KWh by the end of 2012. Total energy savings in excess of 22 million kWh per year are targeted for 2013.

Minimising specific energy consumption

Since inception, DUBAL has continuously striven to be a model in terms of reducing kWh/kg of aluminium production. Through extensive research, the DUBAL Technology Development department has developed proprietary high amperage reduction cell technology that operates at benchmark specific energy levels. The 40 DX Technology cells at DUBAL consume less than 13.2 kWh/kg aluminium (at 385 kA); while the five pilot DX+ Technology cells at DUBAL consume less than 13.33 kWh/kg aluminium (at 420 kA). DX Technology has been installed in the 756-cell Emirates Aluminium (EMAL) Phase I; and DX+ Technology has been licensed to EMAL Phase II (444 cells, currently under construction).

A ground-breaking pilot project has confirmed DUBAL's expertise at retrofitting older potlines with modern technology, leading to greater energy-efficiency. The project, conducted in 2012, successfully reduced specific energy consumption – from approximately 15 kWh/kg aluminium to below 13 kWh/kg aluminium.

Ongoing upgrades, enhancements and energy optimisation activities

DUBAL continuously upgrades and enhances its gas turbine fleet to achieve better energy-efficiency. The pace of change has accelerated in recent years, resulting in a complete upgrade of all Frame 9B General Electric gas turbines.

Many other smaller projects to improve energy-efficiency have been implemented, or are in progress. Together, the projects implemented between 2005 and 2012 have resulted in total fuel savings of 14 million standard cubic feet per day ('mscfd'). This has led to a concomitant reduction in DUBAL's total carbon dioxide emissions of 270,000 tonnes per year, thus simultaneously minimising DUBAL's carbon footprint and the overall impact of DUBAL's operations on the environment.

ABOUT TAYEB AL AWADHI

Tayeb Al Awadhi is Vice President: Power and Desalination at Dubai Aluminium ('DUBAL') (current capacity: 2,350MW and 30MIGD). He joined the company in 1991 and continually strives to improve the availability, reliability and efficiency of DUBAL's combined cycle and co-generation power plants while simultaneously optimising operating costs and minimising the plants' environmental impact. Tayeb holds a Master's Degree (Engineering Science) from University College Dublin, Ireland

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THE MERITS OF WATER-REUSE AND EFFICIENT IRRIGATION

The city gears up with timers, sensors and humble crops such as Buffelgrass to realise up to 8.1 billion imperial gallons of water savings

Water availability is of the highest importance for the Dubai Supreme Council of Energy and the Dubai Integrated Energy Strategy 2030. By ensuring the sustainable supply of this precious resource, Dubai is combining historical local experience and international best practices. The potential is there to save up to 8.1 billion imperial gallons of water, based on a series of well-targeted measures focused on efficient irrigation techniques and the promotion of water-reuse.

The reduction of irrigation water usage needs to incorporate efficient landscaping, irrigation technologies and changing crop mixes to favour less water-intensive species. Xeriscaping is one of the landscape-design techniques that uses on choosing plants suited to arid regions and growing species with low water needs. Another is landscaping that uses of non-organic elements, such as streets and sidewalks, to contribute to landscape aesthetics, while limiting their associated water requirements.

The nature of the crops grown can have a significant impact upon irrigation needs and water consumption. Crops like Buffelgrass require 80%-less water to grow than more commonly-used variants such as Rhodes grass. Buffelgrass can also be grown during the summer months to provide animal feed.

Efficient spray and irrigation techniques can also provide water savings of as much as 20-50% when compared to surface irrigation. Competent irrigation in particular, makes use of timers and sensors to optimise the delivery of water according to ambient conditions. Another alternative is drop irrigation, which limits losses from vaporisation and minimises the waste of fertilizers.

Promotion of water-reuse can significantly reduce Dubai's needs for desalinated water. This is done by increasing the use of treated sewage effluent (the result of a used water treatment process), especially in green areas, industry and construction.

Moreover, water-reuse and efficient irrigation have several benefits that extend beyond water savings. Their increased application could help in building local capabilities and expertise in green technologies, optimise water-resource management and support local biodiversity by promoting native plants. The Supreme Council of Energy will continue to develop its efforts in this front and develop partnerships between public and private players to promote more sustainable water use as of the foundations of Dubai's energy strategy.

> "Efficient spray and irrigation techniques can also provide water savings of as much as 20-50% when compared to surface irrigation."

ABOUT
NASSER AL SHAIBA

Al Shaiba is Director of Environment and Safety at the Dubai Supreme Council of Energy.

AWARD-WINNING INNOVATION IN DISTRICT COOLING

By Ahmed Bin Shafar
Founding member and CEO,
Emirates Central Cooling Systems Corporation (Empower)

EMPOWER replaces fresh water with treated waste water and reduces environmental impact and costs along the way

> “Water blend consisting of 80% RO permeate and 20% of TSE (...) eliminated the need for hazardous chemicals.”

By 2015, the cumulative total demand for refrigeration in the Middle East is expected to reach 2.9 million tonnes. District cooling can potentially reduce annual carbon dioxide emissions by about 1 tonne for every tonne of district cooling refrigeration demand served. This can directly impact this increasing demand by lowering emissions by about 2.8 million tonnes year a year. Despite its large scale benefits, the energy intensive nature of district cooling has set the tone for providers to discover innovative ways to minimise water wastage and efficiently operate chiller systems, while lowering the cost of operation.

Since its inception in 2003, Emirates Central Cooling Systems Corporation (EMPOWER) has provided the city and its neighbouring areas with environmentally viable district cooling services (DCS), by increasing energy efficiency and reducing greenhouse gas (GHG) emissions such as carbon dioxide and ozone-destroying refrigerants. In June 2013 the ‘District Energy Association’ (IDEA) awarded EMPOWER the first ‘Annual Innovation Award’ for their effective use of Treated Sewage Effluent (TSE) in combination with a reverse osmosis (RO) process to optimise the efficiency of their large district chilled water plants and to minimise the use of valuable potable water by testing a series of blended proportions to maximise the water savings.

The project: Dubai Healthcare City plant

As a means of reducing operational expenses, a pilot project looking to replace municipal domestic water with treated sewage effluent (TSE) for cooling was set in place by EMPOWER, coordinating with Dubai Electricity and Water Authority and Dubai Municipality. The Dubai Healthcare City plant was chosen for this project, with the water consumption patterns in 2010 used as a baseline for comparison.

In 2010, the plant utilised domestic water as the cooling tower makeup, and in 2011 this was replaced with TSE. In the history of district cooling in the larger Arabian Gulf, this project was a first; achieving significant savings in water consumption and operational costs.

> “The cost of raw TSE water is ten times less than the cost of domestic water in the Emirate of Dubai”

Challenges

The key concern involving the use of TSE is its high bacterial count and high fouling potential; whether it is to be used directly on the cooling towers, or stored in the premises of the district cooling plant for polishing and treatment. To overcome this challenge, a type of panelled storage tanks were installed with small holding times of between 15 and 20 minutes to avoid storing the TSE water in the permanent concrete tanks and for long periods of time.

Treating sewage effluent also required an initial capital investment in reverse osmosis (RO) technology. As the high quality permeate produced through reverse osmosis has high corrosive tendencies, it is blended with ultra-filtered TSE of higher total dissolved solids (TDS) for it to match the chemical properties of domestic water.
Another challenge was the quantity and quality of the RO plant discharge water. Normally, any DC plant drainage system is initially designed to accept cooling tower blowdown. The DC plant drainage network needs to be upgraded to accommodate the increased quantities of discharge from the RO plant. In order to define the appropriate way to discharge this water, further discussions with local authorities may be required.

4. ENERGY OPTIMISATION AND EFFICIENCY

Finding the balance

From an environmental perspective, using raw TSE or the corrosive RO permeate would require special chemical treatments which involve toxic metals in the corrosion inhibition programme such as Zinc and Molybdate. In order to find a way around that, a water blend consisting of 80% RO permeate and 20% of TSE water purified by Ultrafiltration was selected. This option eliminated the need for hazardous chemicals, bypassed the need for potable water for the cooling tower makeup, and removed the risk of increased corrosion, all while remaining economically feasible. The RO system has been in effect since February 2011.

Financial Advantages

The cost of raw TSE water is ten times less than the cost of domestic water in the Emirate of Dubai. It is evident that using TSE water through any of the given options will involve a significant savings and reduction on the cost of operation of the cooling system.

Moving forward with the 80-20-ratio selection between RO permeate and TSE water, the cost of water per Imperial Gallons was reduced by 85%. The figures used in the calculation are actual numbers extracted from the utility bills collected over the period of 2010 to 2011 for the operation of the Dubai HealthCare City plant. A capital investment was made to install a polishing plant utilising reverse osmosis technology, and the payback period of the plant was calculated to be around 4 years.

Having proven its financial savings, the TSE-RO project has been included in the master plan of all future permanent plants for EMPOWER to utilize TSE water to replace municipality domestic water.

ABOUT AHMAD BIN SHAFAR

Ahmad bin Shafar is a founding member and the CEO of Emirates Central Cooling Systems Corporation (Empower) since the company's inception in 2004. With over 18 years of experience in senior management, he provides strategic direction to make Empower a blue chip company.

DUBAL AND EMAL BECOME EMIRATES GLOBAL ALUMINIUM

On the 3rd of June 2013, Mubadala Development Company of Abu Dhabi (Mubadala) and the Investment Corporation of Dubai (ICD) announced the creation of Emirates Global Aluminium – a jointly-held, equal-ownership company that will integrate the businesses of Dubai Aluminium (DUBAL) and Emirates Aluminium (EMAL) - with plans for significant local growth and international expansion.

The unification of DUBAL and EMAL will strengthen the UAE's position on the global aluminium map.

The formation of Emirates Global Aluminium is an important step towards realising the UAE's vision for a diversified and sustainable economy.

Emirates Global Aluminium will become an engine of economic development for the people of the UAE; it will accelerate employment, with 2,000 additional direct jobs being created by 2020.

Emirates Global Aluminium is being built on a successful partnership between Mubadala, ICD and DUBAL that started with the formation of EMAL in 2006.

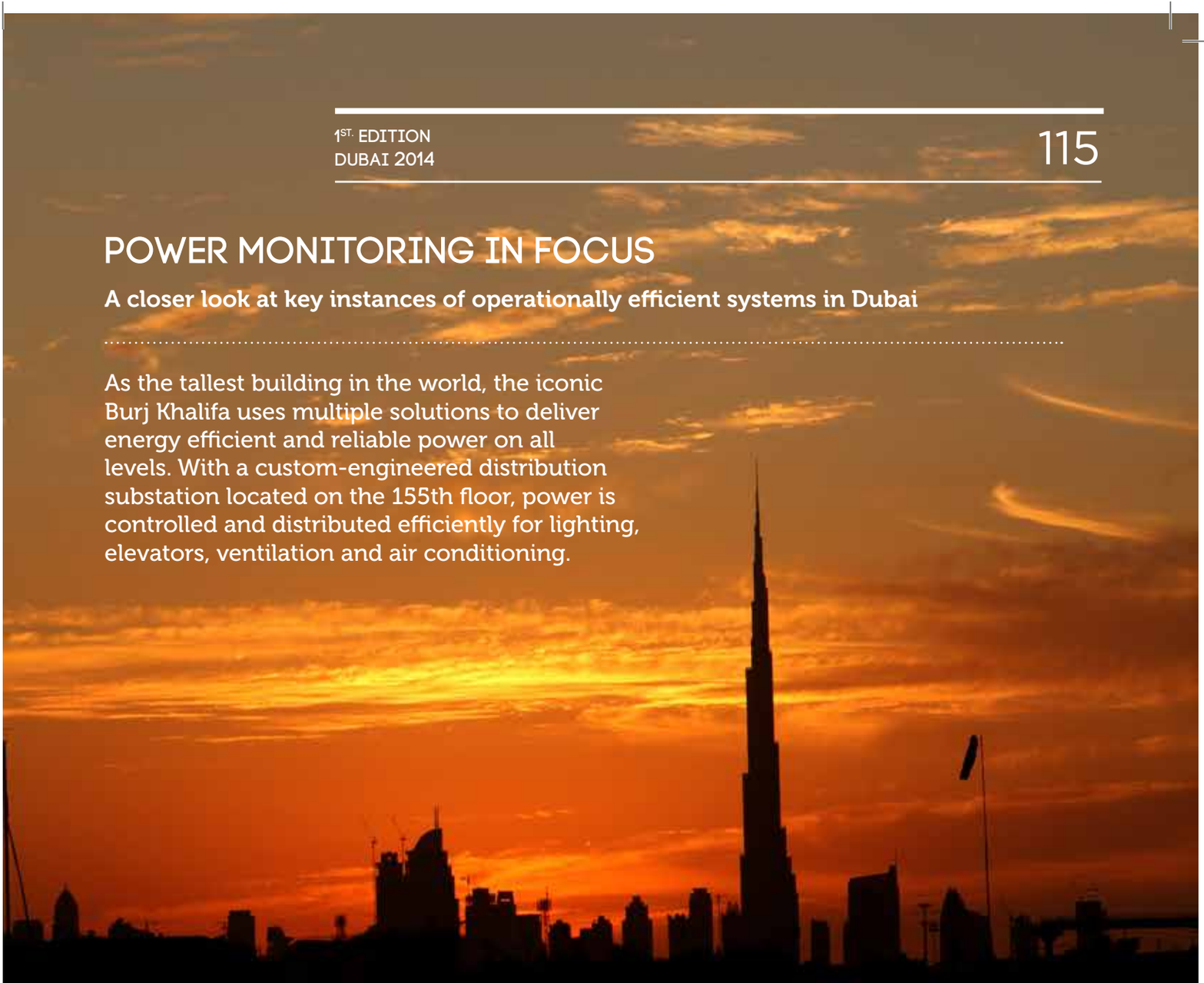
Emirates Global Aluminium will have an aggregate enterprise value of more than USD $15 billion and will be the fifth-largest global aluminium company by production once EMAL Phase II is complete in H1 2014.

Both companies have achieved numerous successes; Emirates Global Aluminium plans to build on these successes to accelerate growth.

POWER MONITORING IN FOCUS

A closer look at key instances of operationally efficient systems in Dubai

As the tallest building in the world, the iconic Burj Khalifa uses multiple solutions to deliver energy efficient and reliable power on all levels. With a custom-engineered distribution substation located on the 155th floor, power is controlled and distributed efficiently for lighting, elevators, ventilation and air conditioning.



The variable frequency drives enable efficient cooling, while a state-of-the-art MicroSCADA control system ensures smooth operation of all electrical equipment. Burj Khalifa's dancing fountain is all about automation; behind the swirling blasts of water lie switchgears, low-loss transformers and systems for power monitoring by ABB. The capacitor banks and harmonic filters further enhance the efficiency and power quality of the fountain's systems.

Emblematic of the manufacturing industry, Al Khaleej Sugar Dubai invested in new process performance motors and an innovative multi-drive application with variable speed control and regenerative breaking. The solution enabled the world's largest sugar refinery to reduce energy consumption by 22% while increasing production capacity of refined sugar by 1000 tonnes per day.

Efficient automation and control of downstream petroleum processes is another area that Dubai's industrial leaders are investing in. Refineries, tank farms, and distribution operations enhance their process reliability, efficiency and safety. One example -Vopack Horizon Fujairah - doubled the capacity of an existing substation and improved productivity of its pumping operations with latest drive technology.

A newly constructed data centre in TechnoPark, Jebel Ali, has been awarded a Tier 3 certification from the UpTime Institute for its efficient design and construction. Spearheaded by Pacific Controls Inc., the data centre has already demonstrated large savings in energy through the modification of its chillers and chiller plant. Having a minimum number of chillers running at optimum compressor load, energy consumption is significantly reduced. Connected to lowering the chiller load, the server rack supply temperature is monitored and managed to meet ASHRAE guidelines and design parameters, utilising Galaxy Platform software. With these energy and cost-cutting measures in place, a before-and-after analysis demonstrates staggering energy savings of 61,820 kWh in one month alone.

One innovation that has potential in the UAE is high-voltage direct current (HVDC) technology that provides upstream offshore oil and gas platforms with efficient and clean power from the shore. Eliminating inefficient gas turbines on the platform itself, the solution can lower greenhouse gas emissions and deliver reliable power via subsea cables from the mainland grid.

CLIMATE FRIENDLY FIRE

As the world continues to combust fossil fuels, Carbon Capture and Storage (CCS) is seen as one way to bridge the gap between energy security and climate friendly business practice. In Dubai, the Dubai's Integrated Energy Strategy foresees the introduction of Clean Coal to the mix.

At Jebel Ali, in the south of Dubai, there is a large cluster of modern power plants; including one of the world's largest aluminium smelters, and other industries. These produce large amounts of carbon dioxide. Offshore, production from Dubai's mature oil-fields has long been in decline. Low-carbon fossil fuel generation and a diversification of the energy mix at a reasonable cost is an opportunity the Emirate is investigating.

Solar power and other renewables are very low-carbon and their costs have come down dramatically in recent years, bringing them close to competitiveness with fossil fuels. But they cannot provide 'dispatchable' electricity – available as and when needed – without expensive energy storage via batteries or other means. At the same time, many important industries – iron and steel, petrochemicals, cement, aluminium, synthetic fuels – produce carbon dioxide as an unavoidable part of the process.

Carbon capture and storage (CCS) is one way to bridge this gap. The International Energy Agency sees CCS contributing to one-fifth of required reductions in CO2 by 2050. As the IEA's Executive Director Maria van der Hoeven observes, "There is no climate-friendly scenario in the long run without CCS."

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Carbon capture and storage (CCS) is one way to bridge this gap. The International Energy Agency sees CCS contributing to one-fifth of required reductions in CO2 by 2050. As the IEA's Executive Director Maria van der Hoeven observes, "There is no climate-friendly scenario in the long run without CCS." Carbon dioxide can be removed from the combustion of coal or gas, and disposed of safely deep underground. When injected into mature oil-fields, it can substantially improve oil recovery, potentially more than paying for the capture process. There are three main ways of capturing carbon dioxide: removing it from the fuel before combustion ('pre-combustion'), burning the fuel in pure oxygen so that the exhaust gases contain just carbon dioxide and water ('oxyfuel') or scrubbing the carbon dioxide from the flue gases with special solvents ('post-combustion').

Carbon capture is often described as an 'unproven' technology, but all the components are well-understood. Carbon dioxide has been used for enhanced oil recovery in the US and Canada for decades, and CO2 has been disposed of underground in Norway since the mid-1990s, and Algeria since 2004. Well-chosen sites should have minimal leakage and pose no risk to the public. Securing sufficient public funding for the first full-scale projects on power plants has been difficult, but they are now moving ahead: Mississippi's Kemper County and Boundary Dam in Saskatchewan, Canada are due to start operations next year.

The shale gas revolution in the US has shown that world gas resources are very large, sufficient at least for the rest of this century. The Gulf region is, of course, very rich in gas, particularly the UAE's neighbour Qatar which already supplies it via the Dolphin pipeline. This means that gas is not a temporary expedient, but a long-term part of the energy mix. Meanwhile, countries such as China, India, the US, Germany and Australia remain heavily dependent on coal, which is not likely to be easily replaced. Making carbon capture work is therefore essential for sustaining a flexible and robust power generation sector, without risking catastrophic levels of CO2 emissions and hence climate change.

Dubai's Integrated Energy Strategy recognises the need to diversify power generation away from a total reliance on gas – to reduce volatility in prices, guard against disruptions and improve negotiating leverage with suppliers. As well as solar and nuclear power, it plans to reach 12 % of power from 'clean coal' by 2030. Clean coal, in this context, is understood to mean ultra-modern power plants that produce very low levels of air pollutants – and, in particular, use CCS.

The Dubai Electricity & Water Authority (DEWA) began working in 2011 with consultants on a 3 gigawatt coal-fired plant with CCS. And last year, the northern Emirate of Ras Al Khaimah announced plans for a smaller, 270 megawatt coal power station that would capture its carbon dioxide to make biofuels.

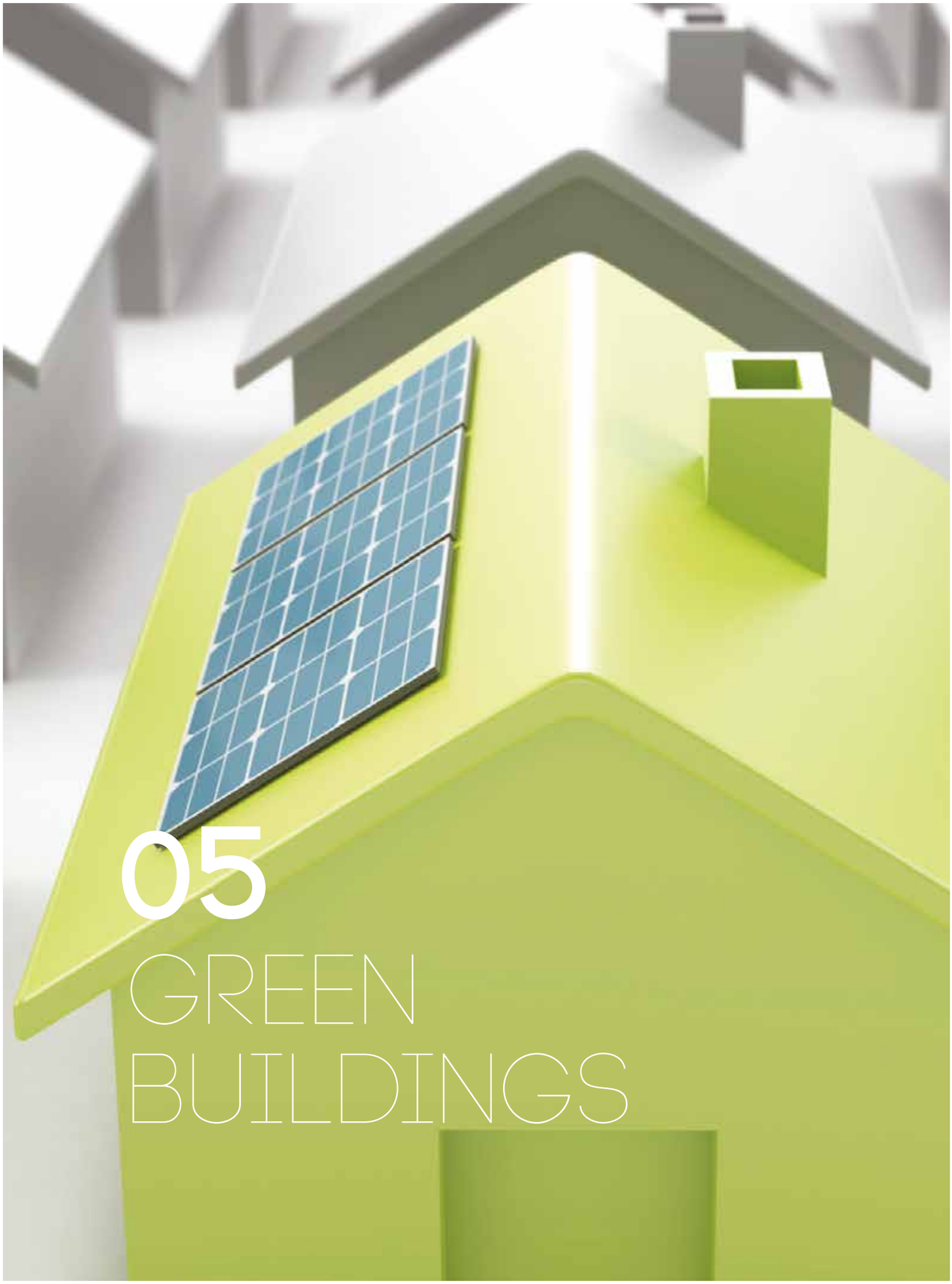
Abu Dhabi's Masdar has studied various plans for CCS-equipped power stations. It is now going ahead with carbon capture from the Emirates Steel factory, using the CO2 for enhanced oil recovery. Steel-making, like some petrochemical processes, produces high-purity carbon dioxide that can be captured at low cost. The Emirate currently injects large amounts of valuable natural gas in its oil-fields – potentially some of this could be freed up. Developing an integrated CO2 network across the UAE, linking major emitters with mature oil-fields, would save costs.

CCS still faces major challenges – not so much with technology, as demonstrating cost-competitiveness, and managing complicated integrated projects. The construction of the first large coal power station in the Gulf is a major undertaking in itself. The progress of the Emirates Steel project, and the various CCS projects in North America, Australia and elsewhere, will be important in giving Dubai the knowledge and confidence in going ahead with its path-breaking clean coal plans.

> "Efficiency gains consist of many small measures which take patience and expertise to identify and implement; a task beyond overworked householders and building managers."

ABOUT ROBIN MILLS

Robin is the Head of Consulting at Manaar Energy and author of The Myth of the Oil Crisis and Capturing Carbon. Contact Robin on robin@oilcrisismyth.com or follow him on Twitter @robinenergy.

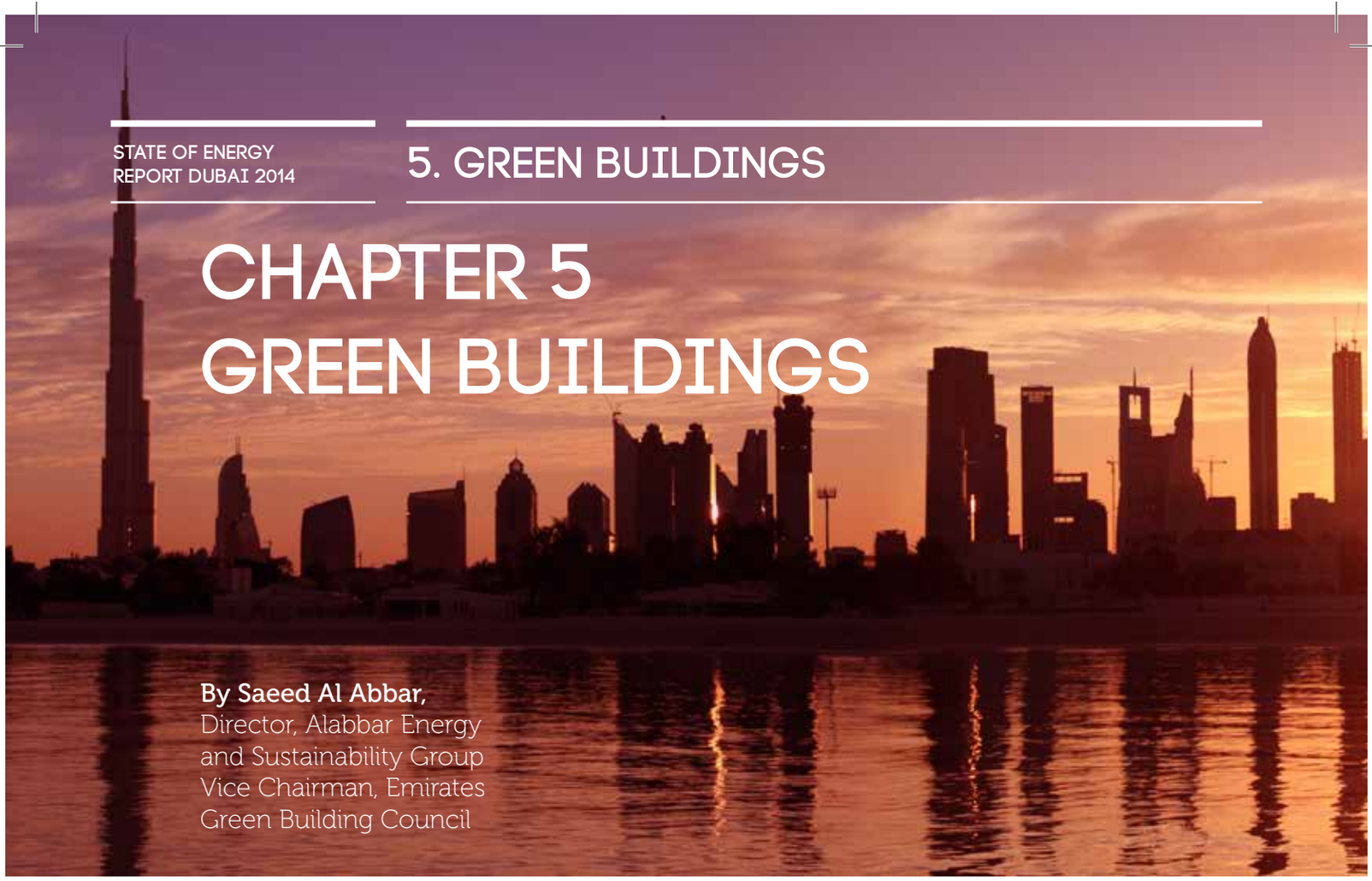


05 GREEN BUILDINGS

The revival of deferred construction projects and the announcement of numerous large-scale developments over the past year is indicative of Dubai's sustained efforts in creating a lasting built environment. With a renewed focus on green building practices and efficient, climate appropriate design, the city's construction sector is being bolstered by Dubai Municipality's regulatory framework in its development stages, focused region-specific rating tools such as Abu Dhabi's Estidama Pearl Rating System, awareness building cooperative associations like the Emirates Green Building Council, and prominent sustainably built or retrofitted public sector sites that are prime of emulation. The largest drain on energy is the heating, ventilation, and air conditioning system within facilities, which needs to pass muster with the Emirates Standardisation and Metrology Authority for use in our desert climate.

HE HUSSAIN NASSER LOOTAH

DIRECTOR GENERAL,
DUBAI MUNICIPALITY



CHAPTER 5
GREEN BUILDINGS

By Saeed Al Abbar,
Director, Alabbar Energy and Sustainability Group
Vice Chairman, Emirates Green Building Council

It is widely reported that buildings are responsible for over 40% of the world's primary energy consumption and for up to 30% of the world's carbon dioxide emissions (UNEP, 2009). In the Arab region, particularly in the Gulf States, this percentage is generally acknowledged to be significantly higher due to the intense air conditioning requirements of buildings and the relatively small contribution of the industrial sector. Rapid population growth, an intense climate and a lack of fresh water resources coupled with a relatively low culture of resource conservation has resulted in energy and water consumption in the Gulf States, as well as carbon dioxide emissions per capita (currently being amongst the highest in the world). This presents numerous economic, social and environmental challenges, which need to be addressed for Gulf nations to maintain their competitiveness in an increasingly globalised economy. It is beyond the scope of this particular chapter to assess these challenges in detail but to provide context, they include;

- Reduced regional oil and gas revenues as a result of increasing domestic energy consumption.
- Increasing costs to the government to continue to develop energy and water infrastructure with the capacity to meet growing peak demands.
- High financial burden to governments in subsidising utility costs for residents, which is a strategy employed widely in the region.
- Extremely high per capita carbon dioxide emissions and environmental footprints.
- Security of energy and water supply

Internationally, it is widely accepted that improving the resource efficiency of buildings presents the most economically feasible option to combating climate change and challenges associated with resource scarcity and consumption. The United Nations Environmental Program (UNEP) estimates that with proven and commercially available technologies, the energy consumption in both new and existing buildings can be cut by an estimated 30 to 80 % with potential net profit during the building life-span. No other sector provides such a viable opportunity for reducing global energy consumption and providing the drastic reductions in global greenhouse gas emissions needed to avoid the most disastrous climate change scenarios.

In Dubai, the high energy and water consumption of buildings presents specific challenges to the Government of Dubai and the Dubai Electricity and Water Authority (DEWA) in particular. Rapid population growth and economic development in Dubai in recent years has resulted in extraordinary increases in the power and water demand of the Emirate. Meeting this demand has required significant and timely investment in developing Dubai's utility infrastructure. With forecasts for power demand set to continue to rise exponentially in future years, meeting this enormous challenge will continue to be critical to the continued economic success of Dubai.

Buildings in Dubai are responsible for the majority of Dubai's electricity consumption; hence addressing the above challenges and enabling the Emirate to transition to a 'Green Economy' requires a strong and concerted effort in reducing the energy and water demand of Dubai's buildings.

Recent years have seen the emergence of 'Green Buildings' as a strategy to address the myriad of global and local sustainable development challenges discussed above. A Green Building (also known as 'Green Construction' or 'Sustainable Building') refers

to a structure that is environmentally responsible and resource-efficient throughout a building's life-cycle: from siting to design, construction, operation, maintenance, renovation, and demolition.

Adoption of the Green Building concept in the UAE

Whilst the term 'Green Building' is relatively new to the region, the concept has been established for a substantial period of time. In the early decades of the 20th century, building construction was extremely sustainable in Dubai due to the lack of availability of centralised electricity and water supply or foreign building materials. Buildings were therefore constructed with a strong focus on using passive design measures to provide ventilation and daylight to the buildings, whilst keeping out unwanted heat. The heritage buildings of Bastakiya in Bur Dubai provide examples of the sustainable architecture adopted in this era.

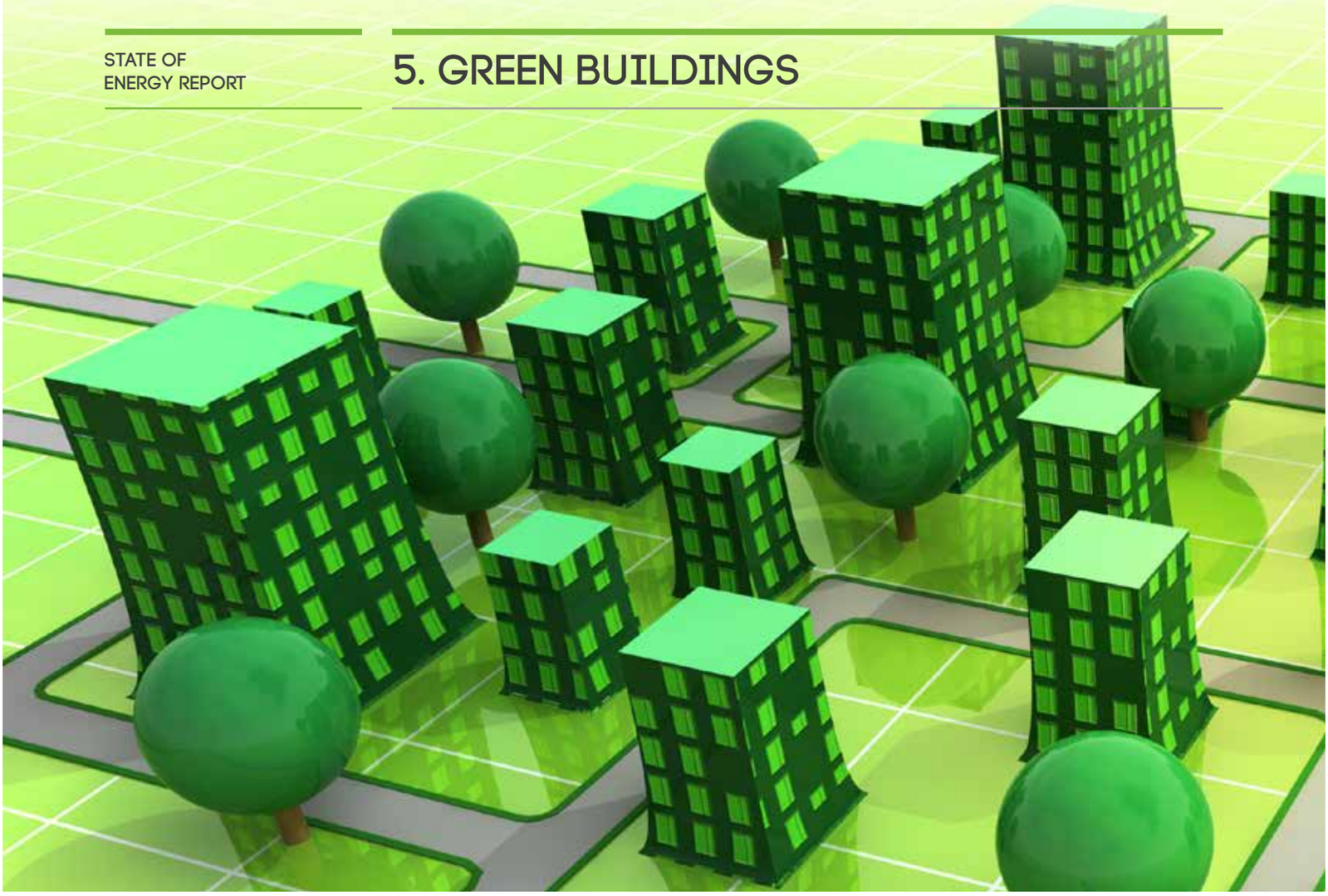
Following the discovery of oil and the introduction of power and water supply to buildings (as the quality of life improved), the design of buildings evolved to resemble more modern air conditioned buildings but still maintained the passive design measures of local traditional architecture (such as window set-backs and shading). Examples of such architecture can be found in buildings constructed in Dubai during the 1970's such as the Dubai World Trade Centre, the Trade Centre Apartments and the Dubai One Television Studio.

As the UAE entered the 21st century, globalisation bought with it many ideas and design concepts from the West, and fully glazed skyscrapers began dominating the city's skyline. The use of fully glazed and therefore poorly insulated facades can be argued to be an inappropriate design concept for the climate in the region, however the concept was frequently used to showcase modernity in new buildings. Costly, energy intensive air conditioning technology was utilised to ensure that the interior of such buildings were able to maintain comfortable interior conditions despite the poor insulating properties of the glazed facade.

Recognising the need to improve building sustainability, local building codes began evolving during this time to incorporate some of the fundamental issues of Green buildings, predominantly with a focus on insulation. In 2001, Dubai Municipality, through Decree No. 66, introduced energy efficiency standards for new buildings. The regulations included the provision of insulation standards for building envelopes, minimum efficiency requirements for air conditioning equipment as well as defined procedures for the calculation of peak building energy demand (in order to ensure better control of power demand growth in the emirate). The introduction of Decree 66 was timely as it coincided with the start of the real estate boom experienced in Dubai and thus ensured that the high number of buildings constructed during this period adopted minimum insulation standards.

Towards the latter part of the last decade, local governments in the UAE began introducing more rigorous codes, such as the Estidama Pearl Rating System in Abu Dhabi and the mandating of elements of the United States Leadership in Energy and Environmental Design (LEED) Rating System for buildings within Dubai World's jurisdiction. Rating systems, such as LEED and Estidama, assess and rate a building based on pre-defined sustainability criteria which typically include; energy efficiency, water efficiency, site location, indoor environmental quality and materials and waste management. Rating systems have been successful in creating a global shift in the market to more sustainable buildings; however their limitations should be understood. Buildings are unique and complex assets and yet provide a uniform set of criteria to rate all buildings is not always possible, hence whilst a buildings rating is a good measure of the buildings sustainability other factors must also be considered such as the buildings absolute energy and water consumption.

5. GREEN BUILDINGS



The LEED® rating system administered by the United States Green Building Council has been widely adopted in Dubai following the mandating of its implementation for projects within Dubai World's jurisdiction. There have also been a number of buildings that have voluntarily followed the LEED® rating system in order to demonstrate stewardship in environmental sustainability. Examples include DEWA's LEED® Platinum rated building in Al Quoz and Standard Chartered Bank's headquarter building in Downtown Burj Khalifa area. At the time of writing, there are 641 projects in the UAE that have achieved the LEED® certification. These buildings provide leadership in the adoption of the Green Building concept in the UAE, however it should be noted that they form a minority of the total buildings within the country and for the green building concept to be effective, it is essential that the majority of the buildings follow the concept and not just the small percentage of pioneers.

The Government of Abu Dhabi developed and subsequently mandated the Estidama Pearl Rating System for all new developments in Abu Dhabi during 2010. The Estidama Pearl Rating System (PRS) provides a minimum level of sustainability certification that all projects must achieve (One Pearl Rating for private developments and Two Pearl Rating for government funded projects) as well as the opportunity for projects wishing to demonstrate leadership to pursue higher ratings. The Estidama PRS has been developed specifically for the region and thus has a high focus on water conservation and energy efficiency. A unique feature of the Estidama system is the implementation of site audits at various key stages in construction to verify that the sustainability features of the project are in fact implemented effectively. The majority of sustainability rating systems tend to be purely documentation based and hence do not provide a robust mechanism to ensure that the project is actually constructed to the high levels of sustainability required to meet the rating. The adoption of a site audit procedure by Estidama has been very effective in ensuring that the sustainability features designed are actually implemented in practice. A key area where this has been successful has been in regulating construction practices for the installation of building insulation systems, which is critical in the climate of the UAE.

Dubai Municipality in partnership with DEWA has developed the Dubai Green Building Regulations and Specifications, which address the key areas of sustainable building development of Ecology and Planning, Building Vitality (interior environmental conditions), Energy, Water and Materials and Waste. The regulations have been developed based on international best practice and provide both mandatory and voluntary requirements within each section. The regulations that become mandatory in 2014 for both the public and private sector address both new constructions and existing buildings.

The success of any sustainability regulation or rating system in creating a market shift hinges on its implementation. The robust, detailed and thorough administration of the Dubai Green Building Regulations and Specifications shall be a vital success factor in the Emirate's transformation to a Green Economy.

> "Urban development and rapid population growth are both key issues impacting the region today. District cooling encourages a greener lifestyle as it reduces energy and water consumption while increasing efficiency. Our aim at Empower is to help position Dubai as a global leader in sustainability and reduce its ecological footprint through the innovation of new technologies and best practice."
>
> Ahmad Bin Shafar, Founding member and CEO,
> Emirates Central Cooling Systems Corporation (Empower)

Existing Buildings

As Dubai is transitioning from a developing to a developed economy, the vast majority of the buildings that will be occupied for the next 25 years have already been constructed. Therefore, to achieve the energy targets of Dubai, it is essential that the energy and water efficiency of existing buildings is tackled as rigorously as new construction practices. Fortunately, implementing energy and water efficiency measures in existing buildings is a viable financial investment with short payback periods and high Internal Rates of Return (IRR). In addition, since the majority of existing buildings in Dubai have been constructed and commissioned with relatively little regard for energy efficiency and have been operated for a number of years with relatively poor operation and maintenance practices, the opportunities for savings in existing buildings are enormous with technologies that are proven and available in the market.

However, the limited availability of financing among building owners is a barrier to the implementation of energy efficiency. Another major challenge that needs to also be considered is the fact that it is often the tenant and not the building owner that pays the utility bill in and therefore there is little motivation for either party to invest in improvements in the building. Coupled with this is a relatively apathetic view to energy bills in the region. For a large number of commercial tenants, the utility bill is not a significant-enough portion of their total operating costs for them to take the effort required to improve the buildings efficiency, even if the upgrade provides attractive returns on investment. Despite the challenges however, the interest in improving the energy efficiency of existing buildings in Dubai has been growing rapidly over recent years.

In view of the above challenges, the Government of Dubai recognises that to achieve improvements in the energy efficiency of existing buildings requires a degree of government intervention to stimulate the sector. The Dubai Supreme Council of Energy, under the framework of the Dubai Integrated Energy Strategy is thus developing mechanisms to stimulate energy demand management of existing buildings in Dubai. The Dubai Green Building Code shall also provide the regulatory mechanism for mandating the implementation of energy efficiency in existing buildings.

A further strategy that can be applied to stimulate the adoption of energy efficiency in existing buildings in Dubai that has been successful in other regions is the mandating of data transparency of a buildings energy and water consumption. This has been widely applied throughout Europe and allows each building to be compared against other buildings for energy and water efficiency in a uniform manner. Implementing a building labelling scheme, such as this, increases awareness among building owners of the relative resource efficiency of their building. This also addresses the motivation gap between landlord and tenant as it provides tenants or potential buyers with the information required to make an informed decision when leasing or purchasing a property on the resource efficiency of the property. Through market forces this shall encourage building owners to take measures to improve the energy efficiency of their building.

5. GREEN BUILDINGS

Conclusion

The Dubai energy sector faces numerous challenges in meeting future peak power demands and supplying clean energy to the country at competitive rates. Substantially reducing the energy and water consumption of both new and existing buildings in Dubai will be a crucial success factor in how the Emirate meets this challenge. A number of initiatives and regulations have been put in place and are under development in Dubai to meet this challenge. The success of these measures will rely heavily on two key aspects;

Ensuring that green building regulations for both new and existing buildings are (suitably) stringent and regularly updated to reflect emerging best practice and administered robustly across all buildings in the Emirate.

The successful implementation of suitable market mechanisms to significantly reduce the actual energy and water consumption of all existing public and private sector buildings in Dubai.

Dubai and the UAE have put in place the framework to be pioneers in the region for the adoption of sustainable development practices in the building sector. It is now the responsibility of both the public and private sector to persevere in the effective implementation of these strategies to achieve the goal of transitioning to a Green Economy.

ABOUT SAEED AL ABBAR

As well as his professional role as Director of AESG, a firm specialising in the provision of energy and sustainability consultancy in the Middle East, Saeed is currently the Vice Chairman of the Emirates Green Building Council and the Vice Chairman of the World Green Building Council MENA Network. In this role, Saeed actively works in promoting the advancement of sustainable building in the UAE and MENA region.

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GAME CHANGER FOR LIGHTING

By Paola Ferreira & Mohamed Al Mulla

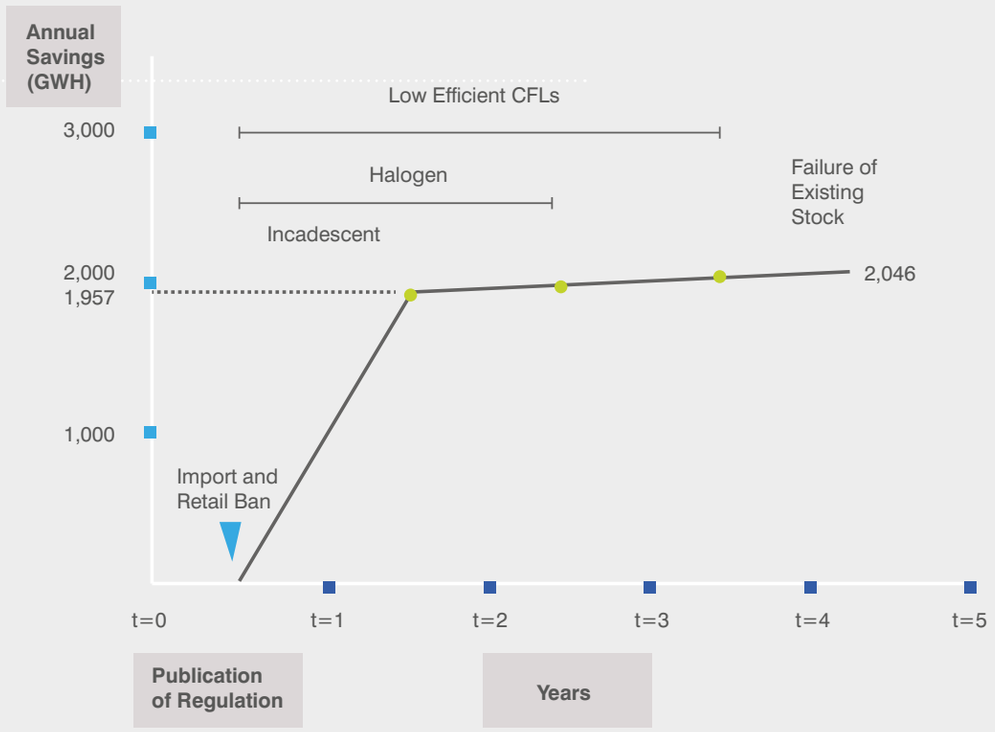
The new 'Indoor Lighting Standard' will save UAE households several hundred millions dirhams annually.

Research shows that implementing demand side management measures, particularly energy efficiency lighting standards in the UAE, can help reduce energy consumption, with substantial co-benefits for the economy and the environment. The UAE Government is considering the approval of an energy efficiency lighting standard.

The regulation includes the four main product requirements for indoor lighting; these include safety, energy efficiency, functionality and hazardous chemical requirements. The standard also specifies that all lighting products need to be certified, labelled and monitored for their compliance with the standard and that they should be disposed of safely with any waste managed according to specific guidelines. Once the standard is announced in the official Gazette, manufacturers, traders and retailers have six months to remove non-compliant products from the market. Products that do not meet the standards specified in the regulation will not be allowed to enter the UAE for retail after this period.

The implementation of the approved energy efficiency standard for lighting can save an estimated 2,046 GWh of electricity in the UAE, under a conservative scenario of 2 hours of usage per day . These energy savings are the equivalent of avoiding investment in approximately 340-500MW of power generation capacity. To put these savings in perspective, the investment required for the Shuweiwat 3 power plant is estimated to be about AED 3.1 million/MW and the effective implementation of the lighting regulation would be the equivalent of AED 1.4-2.1 million/MW. This is the equivalent of avoiding the capital costs of AED 100-146.3 million annually for 20 years. Figure 1 illustrates the timeline for realised energy savings. The figure shows that energy savings phase-in over a period of 13 to 48 months after the regulation's approval.

Figure 1. Timing of energy savings – time 0 indicates the approval of the Lighting standard.



The economic benefits of the standard are also salient as the transition to energy efficient lighting (EELs) is economically viable for both households and the UAE government. An estimated AED 668 million per year will be saved in the UAE after full adoption of energy efficient lights.

Even with higher upfront costs for consumers, the longer life expectancy and lower energy consumption of EELs results in large economic benefits, where households are estimated to save 459 million AED per year after full adoption of EELs. Dubai households will realize the largest share of benefits because they face the highest tariff rate across Emirates.

The economic potential is also evaluated from the government's perspective, which takes into account the difference between the tariff rate in each Emirate and the full cost of power generation (i.e. the level of subsidy being provided by the government). Subsidy reductions to the government are estimated to be 216 million AED per year, with Abu Dhabi realising the greatest subsidy reductions because it has the lowest consumer tariffs.

Finally, if all inefficient lights were replaced by high quality Compact Fluorescent Lights (CFLs), the initial investment cost would be AED 732 million, which would be repaid in 1.1 years due to the cost savings.

The environmental benefits of the standard also make it a win-win policy. The energy savings are equivalent to saving about 940,000 tonnes of CO2-eq emissions, or taking 165,000 cars off of the road each year (RTI, 2012c). This also represents a 65% reduction in direct indoor residential lighting electricity use and a 28% cooling bonus due to reduced air conditioning demand. There are also emission savings in SOx (19,612 MT SO2), NOx (5,075 MT NOx) and particulate matter emissions (44 MT PM).

In order to facilitate a smooth transition to EEL in the UAE, there needs to be concerted efforts across government agencies, civil society, utilities, producers, retailers and the general public.

"All indoor lighting products need to be certified, labelled and monitored for their compliance with the standard"

هيئة الإمارات للمواصفات والمقاييس
Emirates Authority For Standardization & Metrology

5. GREEN BUILDINGS

Table 1 - Net household benefits by Emirate 1,000 AED

Emirate	Annual Increase in Lamp Expenditure (a)	Annual Savings from Reduced Electricity Bills (b)	Net Annual Household Savings (b-a)	Benefit/Cost ratio (b/a)
Abu Dhabi	2,807	73,707	70,900	26.3
Dubai	1,757	166,646	164,889	94.9
Sharjah	1,143	57,130	55,988	50.0
Ajman	301	23,703	23,402	78.9
Umm al Quwain	139	13,882	13,743	100.0
Ras al Khaimah	860	87,263	86,403	101.4
Fujairah	407	36,949	36,542	90.8
Total	**7,413**	**459,280**	**451,867**	**62.0**

ABOUT MOHAMMAD AHMAD AL MULLA

is the Director of Metrology Department at Emirates Authority for Standardization and Metrology ESMA.

ABOUT PAOLA FERREIRA

She is policy advisor for Emirates Wildlife Society in association with WWF.

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ESTIDAMA PEARL RATING SYSTEM: A HOMEGROWN SOLUTION

By Batool Suleimanji

Learning from its established predecessors' rating systems (the British Research Establishment Environmental Assessment Method (BREEAM) and the American Leadership in Energy and Environmental Design (LEED)) the Abu Dhabi Urban Planning Council has created the 'Estidama Pearl' rating system, which incorporates the requirements of the local market.

Developed in 2010, the Estidama Pearl Rating system is a government initiative which includes design and application guides for public spaces, parks and infrastructure. Like LEED and BREEAM, it is a holistic assessment of high-rise buildings, villas and community areas. The Pearl rating system promotes the all-inclusive nature of integrated design, and encourages collaboration between designers, architects, building owners, developers, contractors and facility mangers; it does this from the outset of the project through its close links to the Estidama Integrative Design Process (EIDP). EIDP is set to become part of the Emirate's development codes as a prerequisite for all project types. It will require all projects to carry out a number of analyses before the design process is permitted to begin. This includes solar and contextual analyses, energy efficiency design strategies (including preliminary energy modeling, water budgeting, simple material strategies), and an analysis of potential connectivity to the natural environment.

This rating system, like LEED and BREEAM, is also point-based in awarding projects for elements under general categories. When totaled, these points can award projects with a final rating between one and five pearls, comparable to the four levels of LEED (Certified, Silver, Gold, Platinum), and the five levels of BREEAM (Pass, Good, Very Good, Excellent, and Outstanding). The bar for a five-pearl rating is set at an exceptionally high 90% (compared to BREEAM's 85% for 'Outstanding' and LEED's 73% for Platinum). A Five Pearl certified project requires an overall positive contribution to the environment in terms of energy, water, and improving biodiversity.

There is a great importance placed on water conservation in the Pearl rating system to account for the UAE's demand for desalinated seawater. This rating system also puts more emphasis on materials, indoor air quality, and post-occupancy management, providing a longer-term vision for a sustainable built environment.

ABOUT BATOOL SULEIMANJI

Batool Suleimanji is a Project Support Officer at Dubai Carbon, with professional experience in Project Management and Community Outreach. Batool graduated from University College London with Masters in Town and Country Planning, with a specialisation in Urban and Sustainable Development.

THE ENVIRONMENTAL CENTRE FOR ARAB TOWNS (ECAT) IN DUBAI

Primarily a scientific research institute, prioritising natural resources and environmental concerns, the ECAT pairs economic progress with sustainable development. It does so through its affiliation with the Arab Town Organisation (ATO), and operates under the umbrella of the Director General of Dubai Municipality and ten representatives from ATO member cities. The centre offers research services and material for building awareness to all the member cities within the ATO.

ECAT aims to establish a universal environmental strategy for Arab cities, offering technical support, consultation services and expertise in the fields of environmental health, natural resources and sustainable urban development. The centre organises training sessions, seminars, and conferences and encourages collaboration among regional and international agencies. As a resource for sustainable development, the centre aims to establish an Environmental Data Bank to serve the region.

A CODE FOR A GREEN SKYLINE

By Ahmed Saeed Albedwawi

The Dubai Municipality on the scope of the Dubai Green Building regulation and why an 'all-or-nothing' principal as opposed to a point system was chosen.

From as early as 2008, Dubai Municipality (DM), in collaboration with DEWA, has been honing a watertight set of regulations for new development projects in Dubai to be energy efficient in design and operations. This three-part regulatory framework will become mandatory for all building permit applications submitted by 2014.

The 79-point framework has been carefully composed after years of assessment and evaluation based on leading examples of best practices globally, while placing Dubai's climatic requirements as a priority. The new specifications are all concerned with improving the energy efficiency and carbon footprint of buildings, considering the Emirate's heavy reliance on heating, ventilation and air conditioning (HVAC) systems.

Expounded over three books published by DM, the Green Building Regulations and Specifications are fragmented into seven sections, including landscaping and resource efficiency. The regulations, mandated and inspired by Dubai's ruler His Highness Sheikh Mohammed bin Rashid Al Maktoum in 2008, are in line with the Dubai Strategic Plan 2015, in merging environmental practices from other codes modified to suit the city's distinctive needs. Steered by a team of leading engineers, architects and consultants, the green building codes are currently mandatory for all new buildings issued by the public sector. According to Senior Architect, Adel Mohammed Mokhtar (who works in DM's Building Studies department) this further emphasises the public sector's role as a leader in establishing an ideal model for the private sector to emulate.

Working with consultants with expertise in the American Leadership in Energy and Environmental Design (LEED®) and the British Building Research Establishment Environmental Assessment Method (BREEAM), Mokhtar highlights how Dubai's codes reflect the best points from both systems; tangentially creating a code that works on an 'all-or-nothing' principal, rather than a point system. "The aim is to lower Dubai's ecological footprint through a marked improvement in design standards. LEED®, BREEAM and Abu Dhabi's Estidama Pearl Rating System are just that—rating systems. These standards were extremely useful in our study, but we have developed codes that are essential in any building project in Dubai in the future. These codes are required, without which DM will not approve the project," Mokhtar states.

"We are constantly sharing information with our stakeholders, welcoming feedback and success stories that can help shape the codes to be stronger and all encompassing. These regulations are going to be mandatory in the future, which means that they need to be perfected over the course of time, through dialogue with experts and those in the field."

Mokhtar has spent the past few years continuing his directive to increase awareness of these regulations by addressing developers, contractors and public sector entities.

DM has liaised with numerous local universities with strong design and architectural courses to develop modules specifically highlighting the importance of green design, and methods and strategies for young architects-in-training to design projects that are compliant with the green codes.

"The regulations we have in place are reflective of the direction Dubai is heading towards. It is clear that sustainable design is the future. It's the only way we can preserve the city's vibrancy for generations to come, and through these codes, we want to set standards for Dubai that are not based on commercial rating systems. The regulations aren't designed as a point system. They are concrete guidelines that must be followed. While currently these regulations are optional for the private sector, this will soon change," Mokhtar concludes.

“The green building codes are currently mandatory for all new buildings issued by the public sector.”

“The Green Building Regulations and Specifications are fragmented into seven sections, including landscaping and resource efficiency.”

Inside Dubai's Green Building Regulations and Specifications

1 Ecology and planning:
- Landscaping
- Pollution
- Microclimate and indoor comfort
- Responsible construction
- Environmental impact assessment

2 Building vitality:
- Ventilation and air quality
- Thermal comfort
- Acoustic comfort
- Hazardous materials
- Daylight and visual comfort
- Water quality

3 Resource effectiveness:
- Energy building fabric
- Building systems
- Commissioning and management
- Onsite systems: generation and renewables
- Water conservation and efficiency
- Commissioning and management
- Onsite systems: recovery and treatment
- Resource effectiveness: materials and waste and materials and resources
- Waste management

The Green Building Regulations and Specifications handbook is available online at www.dm.gov.ae, or at the Dubai Municipality Headquarters in Deira.

ABOUT AHMED SAEED ALBEDWAWI

Ahmed heads the Building Studies Unit of the Building Department at Dubai Municipality.

Interview

Interview: Adnan Sharafi

Chairman, Emirates Green Building Council

Supporting Dubai with bold steps taken towards sustainability.

EmiratesGBC
مجلس الامارات للابنية الخضراء
Emirates Green Building Council

Since its inception in 2006, Emirates GBC has focused on promoting sustainability in the built environment through collaboration between various agents. Can you tell us more about how Emirates GBC has facilitated this within the construction industry and the wider community in the past year?

Adnan Sharafi: The Emirates Green Building Council (Emirates GBC) is a forum and a facilitator for sharing knowledge and facilitating collaboration between various stakeholders that influence policy. Our goal is to promote sustainable built environments, complementing the 'Green Economy for Sustainable Development,' vision announced by UAE Vice President and Prime Minister and Ruler of Dubai His Highness Sheikh Mohammed bin Rashid Al Maktoum.

Emirates GBC's vision is to support the UAE to be one of the five global leaders in helping to reduce the ecological footprint of the sustainable building environment by 2015. We achieve this by creating an active dialogue on buildings versus environmental sustainability, and encouraging various stakeholders to adapt and promote sustainable built environments. Emirates GBC also facilitates retrofit projects between owners and our members who are the service providers.

We organise a series of events on various aspects that are important in the implementation of sustainable buildings in the UAE. Since 2011, Emirates GBC has held over 30 events attended by more than 1,300 industry professionals. In addition, we have facilitated trainings in LEED® and energy management for over 300 people. Last year, we organised the first annual EGBC Congress to facilitate knowledge sharing among all stakeholders on a wider scale. The Emirates GBC awards have been launched also, aimed at encouraging innovation and recognising companies that demonstrate clear implementation of sustainable design, construction, and/or operation of buildings.

How can existing buildings minimise energy use and the associated emissions in the local context?

Adnan Sharafi: Since our inception in 2006, there has been significant change in the attitudes and demands related to the sustainable built environment. The more awareness we create, the bigger the chances of reducing these figures.

About 70% of the electricity use in a building goes into cooling, 18% into lighting, and the rest for various mechanical and electrical plants and equipment. On the other hand, buildings account for over 80% of all electricity consumed, which is over double the average world building carbon footprint.

It is obvious that the consumption of the HVAC system is to be reduced drastically. The first line of defence is the building envelope, through which we gain most of our summer heat. Use of highly thermal resistant building fabric, reduced glazing, shading of glazed areas, air-tightness, and reflective colours/coatings helps reduce ingress of heat or loss of coolness. The next line of defence is the HVAC plant that consumes energy to cool the building, and we can start by shading rooftop air conditioners. We need a plant that cools/heats air and water with the least amount of energy and if possible, using renewable energy.

Sustainable lighting solutions are now available with extremely low energy consumption, and we need to maximise daylight use.

5. GREEN BUILDINGS

In your expert opinion, what are some ways in mitigating the direct (heating, lighting, ventilation) and indirect (construction activity, transportation of workers/materials, treatment of water and waste) energy impact of high density buildings?

Adnan Sharafi: To address indirect energy impact, the use of recycled concrete ingredients, use of composite reinforcement and composite materials, reuse of timber and recycling of waste wood and chipping, and use of modular, standard, prefabricated components are ideal to promote sustainability. Indirect energy impact can also be reduced by using machinery to erect components, reducing high carbon encapsulated material, and use of materials with high strength to weight ratio. The strategy must be to plan from cradle to cradle – a truly integrated approach.

For treatment of waste and water, reduction at source provides the greatest advantage, and depending on the project details, the water can be treated and reused or fed into the municipal irrigation system. Recyclable waste separated and sold, and organics converted to energy through a clean and efficient process that does not emit any greenhouse gasses.

Where do you think Dubai stands in the global context when it comes to intra-industry awareness on adhering to (national, regional or international) standards, or even resource efficient self-regulation?

Adnan Sharafi: Dubai has taken bold steps towards sustainability. In addition to the 'green economy for sustainable development' vision, Dubai has also launched the Dubai Integrated Energy Strategy 2030, under the Dubai Supreme Council of Energy, to promote renewable sources of energy and reduce energy demand.
In general, Dubai has adopted many international standards in the construction industry and given the leadership and its vision, we are clearly poised to demonstrate our industry thought leadership in sustainable built environments.

What role does Emirates GBC currently play to this effect (where do you stand on urging emirate-wide standards, frameworks, legislation)?

Adnan Sharafi: Emirates GBC is engaged with the UAE standards body ESMA to help come up with the required standards for building and component energy efficiency. ESMA has already introduced standards for air conditioners. We have also identified the relevant international standards that need harmonisation and adoption. These standards would need to be called upon by legislation for enforcement. We also work with relevant local/federal bodies that need to be engaged in the standards making process and enforcement of regulations locally within the framework of the UAE constitution.

The Emirates Green Building Council (Emirates GBC) was formed in 2006, with the goal of advancing green building principles that help protect the environment and foster sustainability in the United Arab Emirates.

The Emirates GBC offers support to the green building industry as they work towards a more sustainable future by:

- Building capacity and strengthening the community supporting local green building practices
- Offering networking opportunities
- Influencing policy and regulation related to sustainable building environments
- Providing resources and information to those active in the sustainable building community.
- Providing the link between international Green Building movements and the local industry

حكومة دبي
GOVERNMENT OF DUBAI

بلدية دبي
DUBAI MUNICIPALITY

المباني الخضراء
Green Building

دبي .. حيث يبدأ المستقبل

Dubai..Where Future Starts

Dubai, with its green initiatives, has developed over the last few years to allow those viewing the city a truly breathtaking experience. Quite different from other overcrowded and dense cities, Dubai further asserts its reputation as an oasis in the desert - with its stunning architecture and extreme modernity. Importantly, and intrinsic to its modern outlook, Dubai assures the purity of air through its sustainable development strategy, adhering to international standards, which include, sustainability, energy conservation, optimal use of water and energy, control of environmental contaminants and greenhouse gas emissions (amongst others).

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Our Vision: Creating an excellant city that provides the essence of success and comfort of sustainable living.

THE GREEN BUILDING IN AL QUOZ

With the opening in February of its service centre in Al Quoz, the Dubai Electricity and Water Authority (DEWA) became the owner of the most 'Energy Efficient Building' in the region, demonstrating 66% energy savings.

The entire project team worked on integrating this building with DEWA's vision of 'A Sustainable World-Class Utility'. With an area of 31,587 square metres, the service centre is also the largest government building in the world to be given the highest ranking – 'platinum' - under the Leadership in Energy and Environmental Design (LEED®) green building rating system. The building achieved 98 (out of a maximum of 110 points) under LEED® 2009 for 'New Construction', addressing the whole building and not just the commercial interiors.

As with all LEED® projects, this also started with the LEED® charette - a meeting of all stake holders involved in creating the project. The team discussed the then-current project design and the necessary requirements to achieve the high rating. Key issues discussed with facade enhancement, HVAC systems upgrade, lighting and plug load reduction and others.

The team consisted of senior DEWA representatives and members of its architecture and engineering team; as well as staff from Al Turath Engineering Consultants -(the consultant for the project) and Diploma Emirates Building Contracting (the main contractor). The sustainability and LEED® Strategies were developed and managed by the LEED® Consultants and Engineers, Green Technologies FZCO; their responsibility included the engineering strategies and calculation, energy and daylight modeling, integrating the LEED® process and coordinating the work with the Green Building Certification Institute in Washington DC, USA.

As one can imagine, aiming for the highest level of green building certification had inherent challenges. This achievement was made possible due to DEWA's strong conviction, together with the enthusiasm and dedication of the consultancy and contracting team.
The most striking of the building's sustainability features is the fact it is 66% more energy-efficient than a baseline building described in the ASHRAE Standard 90.1 energy standard. This exceeds the maximum energy efficiency threshold defined by LEED®, thereby demonstrating an exemplary performance in this area. With a targeted energy use intensity of 120 kilowatt hours per square metre per year, DEWA's service centre is approximately 3.5 times more efficient than a conventional Dubai building.

Further, a significant part of the building's electricity is provided by solar power. A 600-kilowatt rooftop solar power system produces energy by capturing the sun's light via photovoltaic (PV) cells. The rooftop system is the largest of its kind in Dubai. The building also relies on a solar thermal system for its hot water needs.

Today, the DEWA Sustainable Building stands as the Largest LEED® Platinum (v2009 NC) government building in the world, and has set high standards of sustainability to comply with the realisation of the vision of a highly sustainable Dubai, an icon for the region to emulate.

DUBAI CHAMBER'S GREEN BUILDING LEGACY

Case Study

When the Dubai Chamber of Commerce and Industry head office was opened in 1995, the building was much like many other modern structures in the region. Following an extensive retrofit, the Dubai Chamber now stands out as an icon of green construction in the Emirate

Headquartered in one of the Middle East's greenest buildings, Dubai Chamber was initially a spectacular glass facade high-rise building, which consumed vast amounts of water and energy while producing significant waste. In 1997, Dubai Chamber started working on making simple changes to improve the sustainability performance of this building. In the following 10 years, water and energy consumption was reduced by 77% and 47% respectively, leading to an accumulated savings of USD 1.93 million. In 2009, Dubai Chamber was awarded the US Green Building Council Leadership in Energy and Environmental Design (LEED®) Existing Building certification – the first in the Arab world. It demonstrated, for the first time in the region, that buildings can be 'greened' without significant investments—through good operational practices which benefit building owners and occupants alike.

The LEED® green building framework guided Dubai Chamber through recent building renovations, helping it apply the latest global standards, which lifted staff satisfaction within the premises from 56% to 88%. These standards encompass much more than just energy and water; including sustainable transport, indoor air quality and purchasing. For example, CO2 monitors, segregated printing areas and eco-friendly cleaning products safeguard staff from harmful chemicals. Taps have aerated water flow fixtures and toilets are flushed with treated sewage effluent instead of drinking water, using 4.5 litre flush valves that save thousands of litres of water an hour. Efficient lighting with daylight and motion sensors, as well as open daylit workspaces reduce lighting loads, while a centralised waste area has lifted recycling rates to over 80%. Outside the building, the water fountain that runs on condensate captured from the air conditioning system is used to cool the server room so the chillers can be switched off after hours. To lock in, monitor, and improve on such environmental efforts, Dubai Chamber maintains an environmental management system in line with ISO14001, and plans many more innovative green building initiatives in the near future as well.

Dubai Chamber's green building efforts have come a long way in the past 16 years, demonstrating how green buildings reduce costs, enhance efficiency and productivity, and improve the world we live in. This helps promote Dubai as a place where international best practices are applied, and encourages other organisations to realise the benefits of going green.

About Dubai Chamber
Established in 1965, the Dubai Chamber of Commerce & Industry is a non-profit public entity, whose mission is to represent, support and protect the interests of the business community in Dubai by creating a favourable business environment, supporting the development of business, and by promoting Dubai as an international business hub.

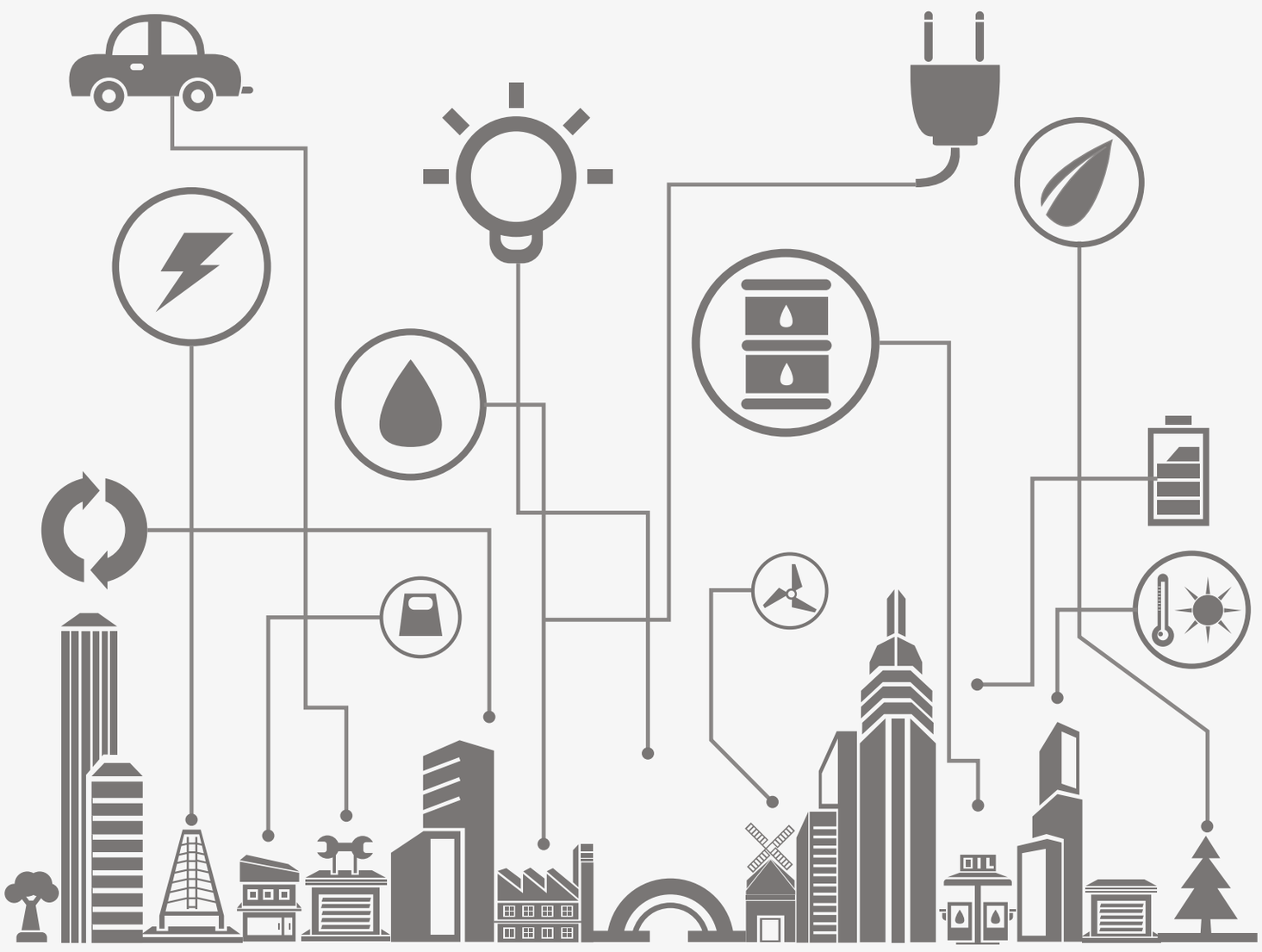
EFFICIENCY AS A MEANS TO A SECURE ENERGY SUPPLY

By Yamina Saheb

The Emirate of Dubai is currently a net importer of natural gas and currently 99% of its fuel mix in electricity generation is natural gas.

The perception of energy security risk varies across countries. The Emirate of Dubai is currently a net importer of natural gas and 99% of its fuel mix in electricity generation is natural gas. Disruptions to primary energy supplies remain a major threat to energy import-dependent economies, which include a large proportion of IEA countries. The oil crisis of 1973-1974 and the need to reduce oil dependency were the catalyst for IEA countries to develop energy efficiency policies. Governmental responses to the threat of such supply disruptions are generally threefold i) develop policies to reduce the growth rate of primary energy consumption, ii) eliminate energy waste and iii) use energy more efficiently.

In the 1990s the focus began to change. Concerns about climate change led to more stringent energy efficiency requirements. Today, energy efficiency policies are being implemented worldwide. The aim of such policies is to address the challenges of energy security, as well as those related to climate change and economic growth.



ABOUT YAMINA SAHEB

She is the Head of Sustainable Buildings Centre at the International Energy Agency in Paris, France with over 13 years of experience in buildings and appliances energy efficiency. Yamina holds a Ph.D in Energy Engineering and an Engineering degree in Buildings.

Despite the progress made in the design and the implementation of energy efficiency policies, global total final energy consumption (TFC) has increased by 38% from 1990 to 2010, to reach 8,682 Mtoe. Non-IEA countries accounted for most of this growth. BRICS countries (Brazil, Russia, India, China and South Africa) recorded an increase of 58% from 1990 to 2010 while IEA countries experienced an increase of 17% over the same period.

It should be noted that buildings are the largest consumers of energy. The sector's global final energy consumption doubled between 1971 and 2010 to reach 2,794 Mtoe, driven by population increase and economic growth. The residential sub-sector remains the largest consumer of energy at a global level, and the non-residential sub-sector has increased its share since 1990, especially in the BRICS countries.

Under current policies, global energy demand from buildings is projected to grow by an additional 838 Mtoe by 2035 (compared to 2010). This is equivalent to the current energy demand of the buildings sector in the United States and China combined. Most of this growth will result from the increase of buildings' energy use in non-IEA countries.

From an economic perspective, energy expenditures place a heavy burden on most IEA countries' balance of trade. For example, at the EU level, total gas trade deficit represented 41% of the total trade deficit with the rest of the world in 2010. In a number of countries, such as Austria, Italy and the Slovak Republic, reducing the energy deficit could bring the balance of trade back into a more positive frame. For countries with a dependence on oil and gas exports to drive their economy, reducing the amount of energy consumption within the country increases revenues generated from exports.

Given the extent of energy consumed by buildings, the buildings sector plays a pivotal role in energy dependency and vulnerability to primary energy source disruption of most IEA countries. Reducing energy demand of this sector is crucial to ensuring long-term global energy security and reducing energy expenditures as demonstrated by the IEA Efficient World Scenario.

DUBAI'S SOLAR POWERED SOUQ

Situated in the heart of Bur Dubai, Souq Al Fahidi replicates the old world charm of a traditional Arabian bazaar in its architectural design and promotion of local handicrafts, whilst also supporting international commercial outlets.

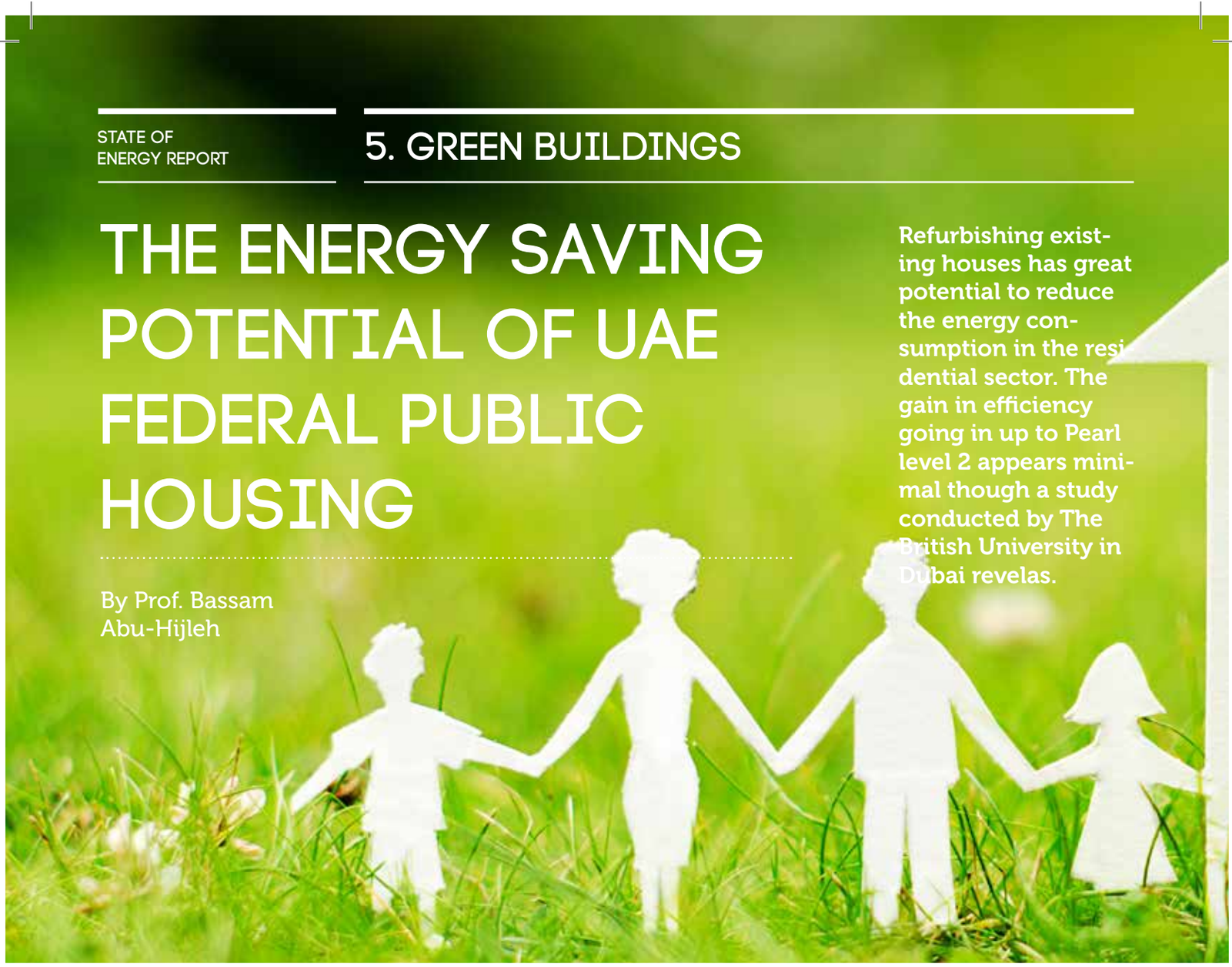
It was constructed in accordance to the Dubai 'Green Building Regulations and Specifications', and in turn it became a hallmark of an energy and water efficient public space. Solar photovoltaic installations onsite cover 340 square metres of the souq's roof. With a 50-kilowatt capacity, the solar installation produces enough electricity to power certain elements of the building, such as its artificial lighting. The rest of the energy generated can be fed back into Dubai's energy grid. This solar system also acts as a water heater, producing around 15,000 litres of hot water a day to match the needs of the various food and beverage outlets within the souq.

With its 232 commercial spaces, 32 outdoor and indoor kiosks, and 302 parking spaces in its basement, it is a flagship green development and being touted as a symbol for sustainable public and commercial spaces in Dubai.

THE ENERGY SAVING POTENTIAL OF UAE FEDERAL PUBLIC HOUSING

Refurbishing existing houses has great potential to reduce the energy consumption in the residential sector. The gain in efficiency going in up to Pearl level 2 appears minimal though a study conducted by The British University in Dubai revelas.

By Prof. Bassam Abu-Hijleh



Sustainability features prominently in the UAE's 2021 vision. Although the focus has been on developing and expanding the use of renewable energy resources; reducing energy consumption per capita is also an important aspect. The focus until now has been on regulations for new buildings. – although existing building stock will play a crucial role.

The UAE is a country in its development 'infancy', and compulsory building regulations relating to energy savings and conservation have only been introduced in the past decade (2003 in Dubai and 2010 in Abu Dhabi). Until 2012 there were no federal building regulations designed to promote energy savings in federal buildings including all federal- built public houses (ranging from 1974 until 2012).

This means that even if all new buildings are to adhere to significantly high energy conservation standards, the UAE will still have a large stock of buildings (some just completed) which have excessive cooling loads, and therefore are not environmentally friendly. It is apparent that the majority of the buildings in the UAE were constructed with little or even no consideration to energy savings. This is especially true for investment buildings built by developers for sale rather than rental income. In such situations initial cost savings were the dominant concern for the developers, resulting in cost/corner cutting measures. As a result, such buildings have had a tendency to experience high energy operating costs.

Several federal public housing villas were studied in research study entitled 'Assessing the Energy Saving Potential of Refurbishing Existing Buildings in the UAE' that assessed the energy saving potential due to refurbishment. The five most popular villa models in each of the past 5 decades (C73, B74, 670, 717 and 762) were chosen in this study. Two refurbishment levels will be used in this study, those corresponding to ESTIDAMA's 1 and 2 Pearls requirements.

Computer energy modeling has proven to be a powerful tool among building professionals and researchers. For this work, the Integrated Environmental Solutions – Virtual Reality (IES-VE) software was chosen due to high level of accuracy and range of capabilities.

Each of the villa models was modeled in IES based on the design data provided by the MoPW. This included architectural, structural and material components. IES was used to calculate the energy consumption of the different villas. This was done for the original configuration of the villas, i.e. as built, as well after the virtual refurbishment of the villas by adding additional insulation and upgrading the existing glazing. The effectiveness of the refurbishment was assessed by examining the percentage change in the energy consumption of the refurbished villa compared to the energy consumption of the original villa. All five models exhibit similar trends, and even values, in terms of energy reduction due to refurbishment.

> “The study covered houses built in the period of 1974-2012”

Acknowledgement

The study was conducted at The British University in Dubai with assistance of Wafa AlAwadhi, Athari AlNaqbi, Abeer Manneh and Ayoub Kazim and has been supported by the Emirates Foundation, ExxonMobil and GASCO under Grant 2011/157.

The results were surprising. Whilst the refurbishment to 1 Pearl level resulted in a significant 27.5-29.8% reduction in total energy, going to 2 Pearls level improve the energy performance by only an addition 0.7-1.1%. This is clear indication that 1 Pearl insulation requirements are good enough for the UAE climate, and further enhancements in these values have little in terms of return.

With no surprise, the biggest reduction in energy consumption occurs during the hot summer months (close to 40% reduction in August). Dubai has only started to tap into this great potential.

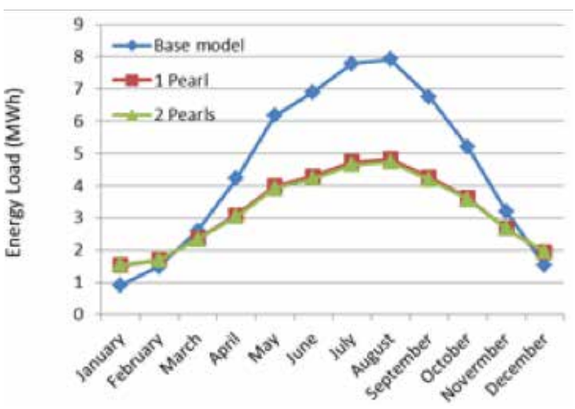


Figure. 2 The monthly total energy consumption for the villa model 670.

> “Computer energy modeling was used to estimate the potential energy savings of refurbishing existing public federal housing in the United Arab Emirates”

ABOUT BASSAM ABU-HIJLEH

Since 2006 Prof. Bassam AbuHijleh has been assigned as the Atkins chair and the head of the Sustainable Design of the Built Environment MSc programme at the British University in Dubai. His interests include energy modeling, conservation & management as well as renewable energy resources. He has a large number of publications in international scientific journals and conferences.

PLANTING THE CONCEPT OF GREEN ARCHITECTURE

Sustainable architecture has a strong history in the region and today's architects look back at tried and tested ideas from the past to create new forms living in the Gulf.

By Daniel Hajjar

To understand the current status of green architecture in the Gulf region it would be prudent for us, with so much at our disposal, to consider the past; and in particular, how appropriate the built environment was (and is), for its inhabitants. Sustainable architecture in the region has long had its foundations rooted in a response to lifestyles which were primarily nomadic, or associated with the commerce of the nearby Gulf. Building materials came from those resources readily available; palm trees and fronds, coral stone and plaster. For the Bedouin, as with any nomadic people, their shelter needed to be transportable, offer protection against the elements and respect the cultural and social mores within a tribe. It is not a surprise that as designers and creators of the built environment, we find ourselves looking back at tried and proven ideas to achieve appropriate solutions that are meaningful and lasting within the unique geographic locale.

With the advent of the hydrocarbon economies, materials from sources previously only read about became available; and for the designers, a chance to import aesthetics and innovations. Sustainable architecture must start with urban form into which a single building is an active participant in the success of that community. What had been forgotten in early planning of Gulf cities is now being reassessed in terms of shading, street widths, service corridors and a genuine concern for the public realm. To create a sense of place requires a thoughtful and considered approach to not only buildings, but urban form as well.

The last ten years in the Gulf Region has witnessed various grass-root organisations with aspirations to make both our social and physical fabric focus on an environment that is responsive to the climate, whilst promoting a reduction in the use of fossil fuels, and arguably more important, our water resources. Leaders of the country have accepted this challenge and instituted new policies to make sustainable communities the norm as opposed to the exception. To achieve sustainable solutions in the built environment requires a paradigm shift; energy costs will continue to climb therefore alternate sources of energy will be required. Both Dubai and Abu Dhabi have embarked on solar farms to begin addressing this concern for the next several generations. A number of projects have also acknowledged this challenge; interestingly enough, both the world's largest and highest LEED® rated projects are located within the Gulf Region. These achievements clearly outline the political determination to address the real issues a society and built environment that was once known as having the highest per capita use of energy and water in the world.

A new consciousness has emerged, yet for it to be successful in the long run, a continued and sustained effort is required from both private and public partnerships to effect change. Citizens have started to look at their city, its public realm and built environment as an asset that requires on going evolution to be successful. The Gulf region is in a unique period of time with the financial resources to fund new initiatives not only in the UAE but also abroad. The government has started to instill the seed in its population that a sustainable legacy for future generations will be founded on appropriate design, social and economic principles. This

is becoming more prevalent, with many government bodies and private groups leading the way in bringing a higher level of consciousness to sustainable planning and architecture within the region.

The planting of a palm seedling held much of the same promise several generations ago that we hold for the future today.

ABOUT DANIEL HAJJAR

He is a Senior Vice President and the Management Principal for HOK an architectural and planning firm in the MENA Region that has been at the forefront of creating sustainable communities and architecture.

THE EVOLUTION OF A HOLISTIC GREEN CODE

By Ahmed Saeed Albedwawi

The quest of Dubai Municipality on the most suitable building materials for the harsh climate and its deployment of the implementation of the building phases.

As the largest consumer of energy and water in Dubai, the built environment accounts for 75% of the Emirate's electricity demand and 86% of its water usage. These staggering figures have prompted Dubai Municipality (DM) to place building efficiency as one of its priorities, in alignment with the emirate's vision for sustainability.

Since 2003, DM has applied thermal insulation as a key method for energy saving, resulting in a direct reduction in power consumption from lowering the load on building air conditioning systems up to 40%.

Taking Dubai's climate into consideration, DM conducted extensive research on the kind of building materials that are most conducive to provide thermal insulation for buildings exposed to more than 12 hours of direct sunlight a day over their estimated 60-year lifespan. Mapping the positive and negative aspects of each of these materials, with reference to their availability and suitability in Dubai, DM then proceeded to share their findings to raise public awareness on the economic and environmental benefits of thermal insulation, including the technical specifications that are ideal for the city.

DM also provided the rubric needed for building owners, developers and contractors to calculate the thermal loads and the determinants of the parameters for air conditioning system design, the specifications of thermal insulating materials, and the requirements for their application.

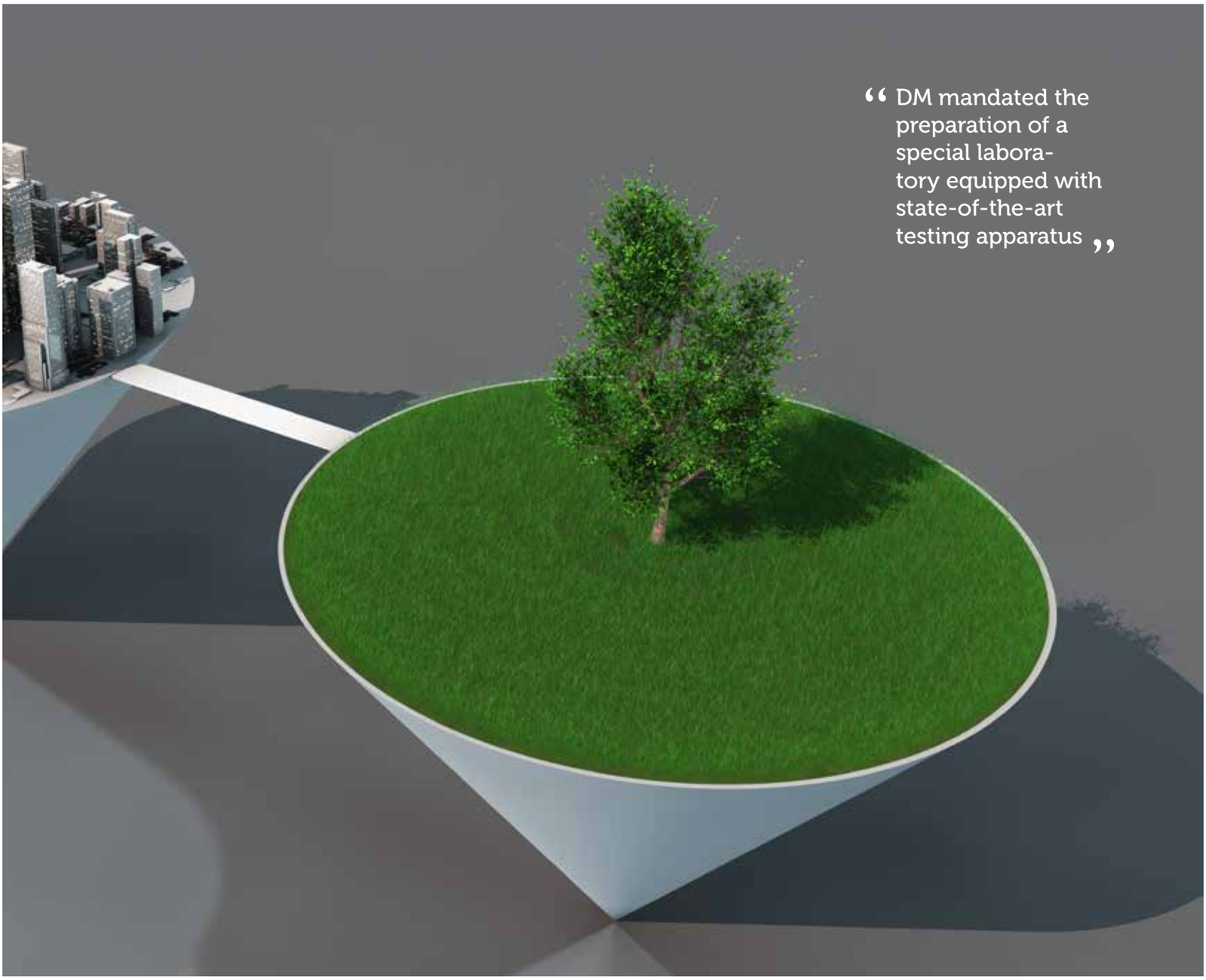
Acknowledging the importance of research and testing for sustainable buildings, DM mandated the preparation of a special laboratory equipped with state-of-the-art testing apparatus and specialised technical staff onsite at the Dubai Central Lab. The civil body also issued procedures and flow charts in the interest of transparency in obtaining building permits. All stakeholders, such as the Building Department, Dubai Central Lab, Dubai Electricity and Water Authority (DEWA), as well as key engineering consultants and construction companies were all involved in an open dialogue before the procedures guide was developed. Comments and questions that have been raised through seminars and lectures held by DM to this effect were taken into account, and are now available online for public access.

Furthering DM's quest for thermal insulation to become a mandated and widely accepted green building practice, a questionnaire was prepared in order to explore the views of stakeholders on the efficiency of the list of technical specifications for thermal insulation systems. Stakeholder's feedback on the seminars, lectures and media campaign was also sought.

As a real-world example of the benefits of the Thermal Insulation Guide, a case study on its application in Government Housing units in the municipality was published, to assess the benefits and constraints that may result from incorporating thermal insulation in the design and construction process.

This thorough rolling out process helped in convincing key stakeholders and the general public on the importance of thermal insulation for lower energy use, making it easy to issue mandates for all new development projects.

Following this success, in 2008, DM began studying the application of the concept



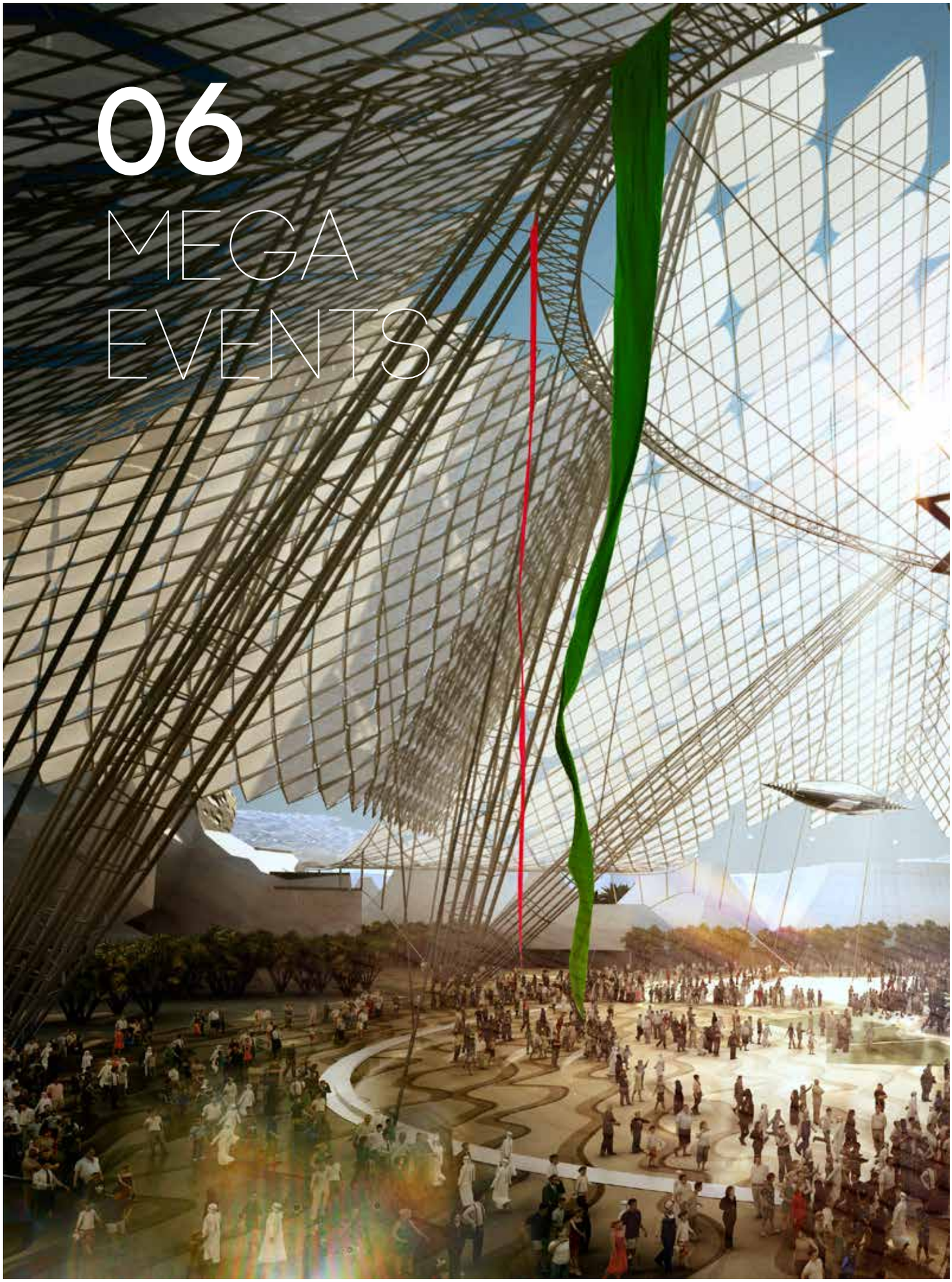
> DM mandated the preparation of a special laboratory equipped with state-of-the-art testing apparatus

of green buildings in phases. The first phase examined quick wins; the application of elements which can be easily implemented for substantial results at minimal cost. This phase also incorporated extensive research on what type of green building rubric would work for Dubai, in terms of its environmental, economic and societal implications. The second phase, which extends from 2011 to the end of 2013, was the mandatory application of the Dubai Green Building Regulations and Specifications on all government buildings. In the third phase, all other projects will need to adhere to these codes (starting in 2014). The same roll-out method that was employed in the mandating of thermal insulation will be replicated for the Dubai Green Building Regulations and Specifications. These codes aim to reduce electricity and water consumption in buildings by at least 20%, whilst ensuring that prices of buildings do not exceed a 5% increment.

ABOUT AHMED SAEED ALBEDWAWI

Ahmed heads the Building Studies Unit of the Building Department at Dubai Municipality.

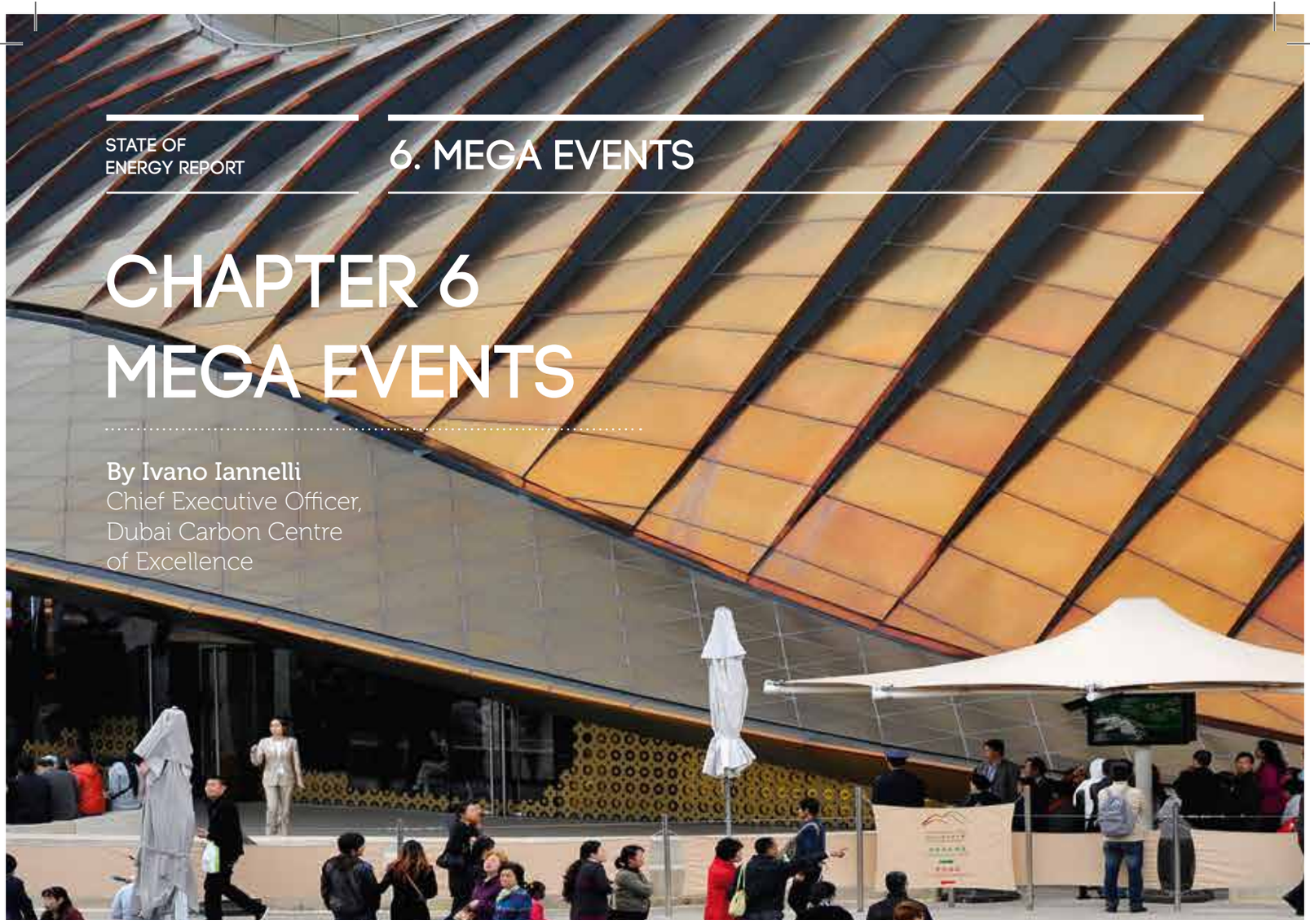
06
MEGA EVENTS



World Expos, Olympic Games and other mega-events have proven to be powerful forces shaping the sustainability of cities and countries. From infrastructure to economic development, from urban planning to quality of life, the legacy of mega-events is inextricably linked to the environmental, economic and social sustainability goals of a nation. Thus, in the last decade, sustainability has become a key objective of mega-events influencing new practices in event strategy, design and management. With this knowledge, Dubai Expo 2020 has set sustainability at the core of its planning. We have integrated and tailored international best practices and lessons learnt from other Expos to develop ambitious sustainability initiatives and targets. While every mega-event sets new benchmarks for future events, we still lack an institutional platform, through which host nations and international oversight organisations can share and capture relevant experiences and lessons learnt. The importance of this platform warrants a combined effort amongst practitioners in relevant domains. This chapter is a first step in developing this platform.

HE REEM EBRAHIM AL HASHIMY

UAE Minister of State & Managing Director of Dubai Expo 2020 Higher Bid Committee



CHAPTER 6
MEGA EVENTS

By Ivano Iannelli
Chief Executive Officer,
Dubai Carbon Centre
of Excellence

CATALOGUING SUCCESS

Each mega event effectively adds to the benchmarking of resource efficiency and best practices, as Ivano Iannelli, Chief Executive Officer at Dubai Carbon outlines.

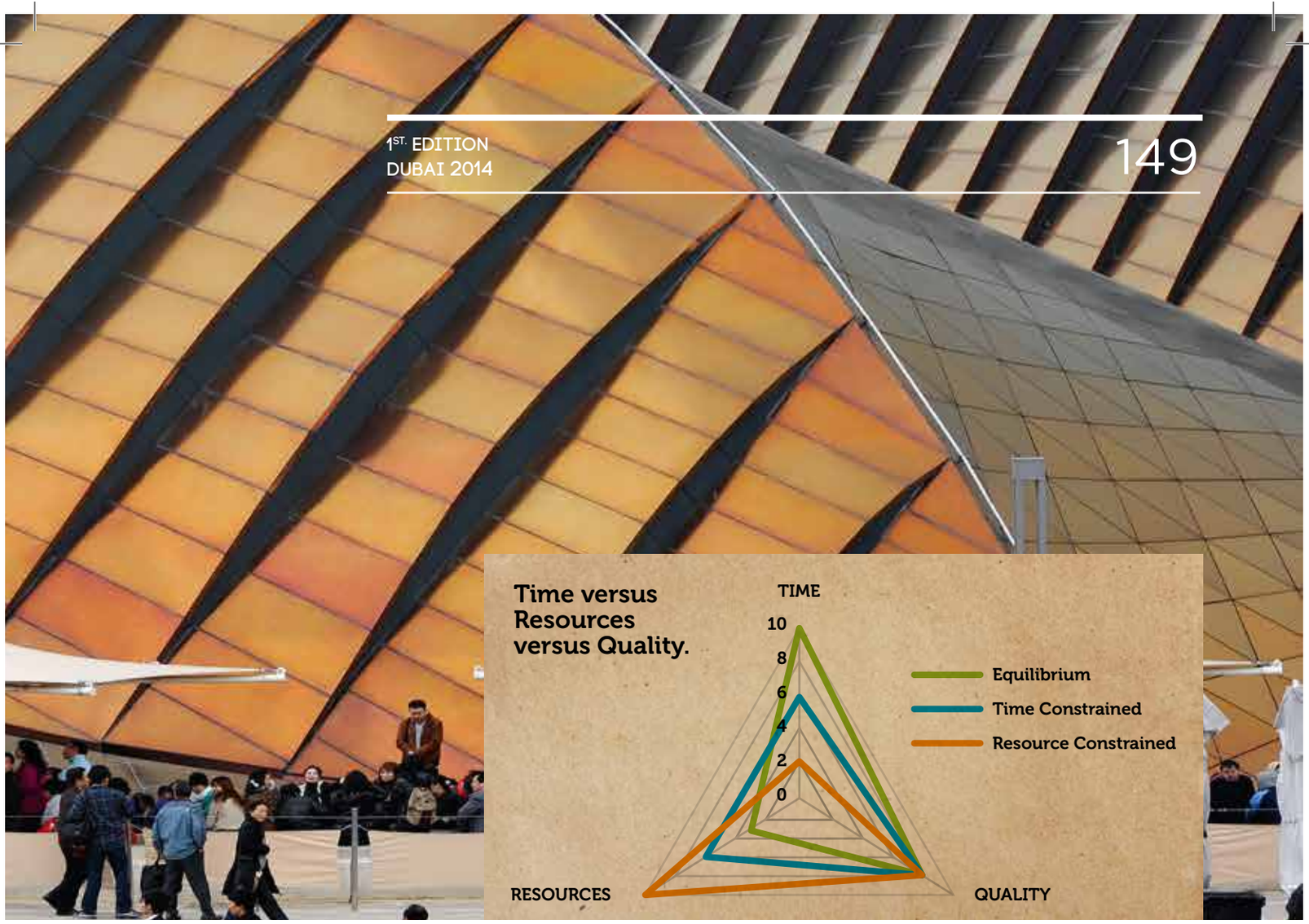
There is a culture of stewardship in the UAE— a key sustainability driver in line with the ambitiousness of its vision. Although clichés such as leading by example and learning by doing are often used in narrative, the concept of replicability is often underestimated.

Mega events are extremely large and complex projects, which rely on the accuracy of planning, while embedding best practices in their design. The sustainability value is derived from the ability to drive resource efficiency in the planning and establish benchmarks as its legacy. Although today you can identify indicators for energy consumption of a building, kilogrammes (kg) of waste per capita and litres of water per person per day, there are no agreed set of indicators towards measuring the resource efficiency of mega events. It is not about a checklist of independent criteria, but rather about how these are pulled together and managed as an interdependent whole, and how best practices are passed along.

Mega events are one of the representations of a project culture. When an event is planned, an ad hoc organisation is created for the purpose of delivering one specific result according to an agreed plan or business case. Essentially, a number of

A study by the South African Tourism board revealed that:

- On average, each traveller spent 10 nights in the country
- Many fans left after their team elimination, while others travelled as a result of team winnings
- Shopping and Night life contributed to a 9% rise in selection of South Africa as a tourism destination
- 5% of the travellers to South Africa for the World Cup indicated a visit to other African countries during their trip



resources is quantified and allocated to deliver an end result, which is qualitatively foreseen. The World Cup in South Africa in 2010 attracted over 300,000 visitors, which put the country's infrastructure to test whilst growing its GDP. At the same time, a structure like the Dubai World Trade Centre exhibition halls handles 1.85 million visitors annually, and showcases over 37,000 companies. World Expos, in the course of a six-month period, welcome tens of millions of visitors, and cater to the needs of operating major pavilions and venues for hundreds of participating countries and organisations.

The complexity of planning for such large-scale events also embeds a responsibility towards the management of the resources required. A project is a mix of three key components: time, resources, and quality. Increasing or reducing one will inevitably impact others. A lot of resources are concentrated on a product, which is delivered over a predetermined timeframe; hence planning is crucial to success. Shortsighted delivery often neglects the entire value chain of the process, and the resources required to achieve the end result are often more than needed.

Dubai is no stranger to events, with 1.85 million visitors in 2012 at Dubai World Trade Centre (DWTC) and 140,000 fans at live events in the first Quarter 2013 . It has positioned itself as a destination of choice for exhibitions and events worldwide. Annually, numerous conferences and exhibitors converge to the city to showcase their products and services. They often travel across the globe in an effort to share the look and feel of their product offering. The Dubai World Trade Centre alone has currently a capacity of one million square feet of covered space, used for over 150 trade and exhibition-related events each year. With thousands of exhibitors at each event, the quest to stand out leads to the setting up of temporary structures, from portable backdrops, to eye-catching multi-story props and office spaces for meeting round-ups. To this end, resources and materials travel across continents, often by air. In many cases, sets are built and not re-used, making a one-way trip to the landfill.

Which scenario is more sustainable? We have seen an increase of "recycled" stand materials being used; often reutilising a set just requires a few new parts and a paint job. In others, we have scalable and mountable kits that, although used a few times before making their trip to a landfill, require tonnes of CO_2 when moving from point A to point B. In all this, there has been no notable effort in capturing data to identify best practices.

Mega events are the opportunity to challenge benchmarks. Such nation-wide activities look into the complexity of handling millions of visitors efficiently whilst combining different elements of the economy in the mix. The Expo in Shanghai in 2010 managed 73 million people over 184 days, a crowded city with a population of over 23 million. Assuming a rather inaccurate average of visitors over the time, the city of Shanghai had to plan accordingly to contend with a temporary surge in capacity, on the way city resources would cope under stress. This does not cover only the demand for hospitality services, such as hotel rooms and public transport, but also the direct demand on power, water and waste generated from the visitors and the indirect impact from the business community, which is expected to cope with the surge.

Source: Ahmed Alkhaja, Senior Vice President – Venues, DWTC
(DWTC Press Release: 01/04/2013)]

6. MEGA EVENTS

Economy

A small disposable bottle of water for each of the 73 million visitors can be metaphorically used as a representative token for sizing the effort. At the beginning of the value chain, the business sector needs to be informed of the realistic number of visitors to plan for their stocks and handling, which in turns may require additional display and cooling. Distributors will respond to such a requirement with additional vehicles, and manufactures may actually plan to improve their production capacity. All this is ex-ante, as we have yet to provide the single bottle of water to each of the 73 million visitors. Distribution and logistics play a key role to ensure that warehousing space is conveniently secured, and you have a suitable network of roads and alternative transportation for all the materials required—from the bottle's plastics to the fuel for the trucks.

Assuming that we have successfully managed our virtual distribution of water, our visitors will now need to dispose of the empty containers, which will once again put strain on the logistics network to ensure waste management is properly handled. Furthermore, if we wish to cover the basics of recycling, we will need to educate our visitors to throw the empty bottles in appropriate bins, through communications and, probably, some printed materials which may end up as waste as well.

The GDP increase as a direct result of the Expo has accelerated the investment activities with an early start. Although the initial budget of US$4.2bn was exceeded, the infrastructure is there to stay. There is no doubt that such a mega event, despite its complexities and capital-intensiveness has visible benefits. The key question is which metric are we benchmarking. No such assessment can be easily found. Knowledge is disseminated but not organised, although an ISO standard charts out the process.

Sustainability

The ISO standard is a management system that allows mapping the best practices in handling events from a procedural standpoint. The standard is complex, and is not a checklist. It applies to small and large events alike, although sustainability practices in an exhibition or a concept will be remarkably different from a World Cup or a World Expo.

Using a simplistic term, we would look at the sustainability component as the ability to efficiently manage resources. The approach would be to achieve any event, despite the complexities and scales, using the least amount of resources while retaining the desired look and feel. This is a massive logistics undertaking based on the world best practices in efficiency and planning.

Energy, waste, water, transport and many more streams have to be coordinated in a clockwork fashion. The end result is not only beneficial to the organisers who save massively in costs, but also to the environment, which has less proverbial waste to deal with. There is not a single model that can fit all, but rather a set of indicators that should be mapped and assessed for their potential to become part of the algorithm that can benchmark the socio-environmental performance of an event.

Design, planning and conceptualisation is not only key, but also likely to change when the time horizon is large. Planning for an event in 2015 and 2020 are very different, as products and trends change. However embedding a methodological approach towards energy consumption may nevertheless be a great start.

Life cycle analysis (LCA) and cradle to grave (C2G) designs become the mega event mantra. Essentially the whole inventory of product and services must be looked upon over its entire life cycle for efficiency. The concept of recycling must accurately capture the value of the byproduct to ensure conformity. In many

instances, resources can be recycled, but their quality is downgraded. When proper LCA is undertaken, virgin material usage is avoided. When budgeting, the cost of disposal is taken into account and warrants for a better product in itself.

Social Development

The repository of such practices is a key to a knowledge economy. Skills and competencies can only be transferred if captured and shared. The South African World Cup in 2010 created 159,000 new jobs, almost a job per every 2 visitors. In many instances best practices were replicable and scalable. The Expo in Shanghai was an ideal piloting scene for innovation, and the United Nations Environment Programme captured some of its lessons learnt in a report, which was widely disseminated.

Such a model would then be applied to future applicants in a way to utilise the event, not only for the tourism value, but also as an enabling tool to achieve substantive results, such as a reduction of CO_2 from the energy infrastructure of mapping out the number of jobs forecasted. In the dossier presented by Dubai for Expo 2020, as an example, the forecast job creation is not only aligned to the Green Economy for Sustainable Development but also expected to generate 277,000 new jobs.

The engine of creativity and innovation have always been linked to the enabling environment where individuals could mingle. The interaction across cultures and backgrounds are a key condition to increasing the knowledge base. In the 17th and 18th centuries, English coffee houses played a pivotal role in what is known as the Age of Enlightenment, just as the Parisian Salons did for Modernism. Nowadays, communities have a more extensive, albeit less personal, playing field which is yet to be captured and harmonised.

Dubai in its own microcosm is a melting pot of communities, cultures and background, which adopt such principles of social exchange. The ability to foster such a forum would enhance the ability to capture and consolidate a Sustainability Compendium of best practices. What is done today on an informal level when a South African event organiser joins a local event management company, would conceptually avail the key notions for replicability and scalability across a much larger audience.

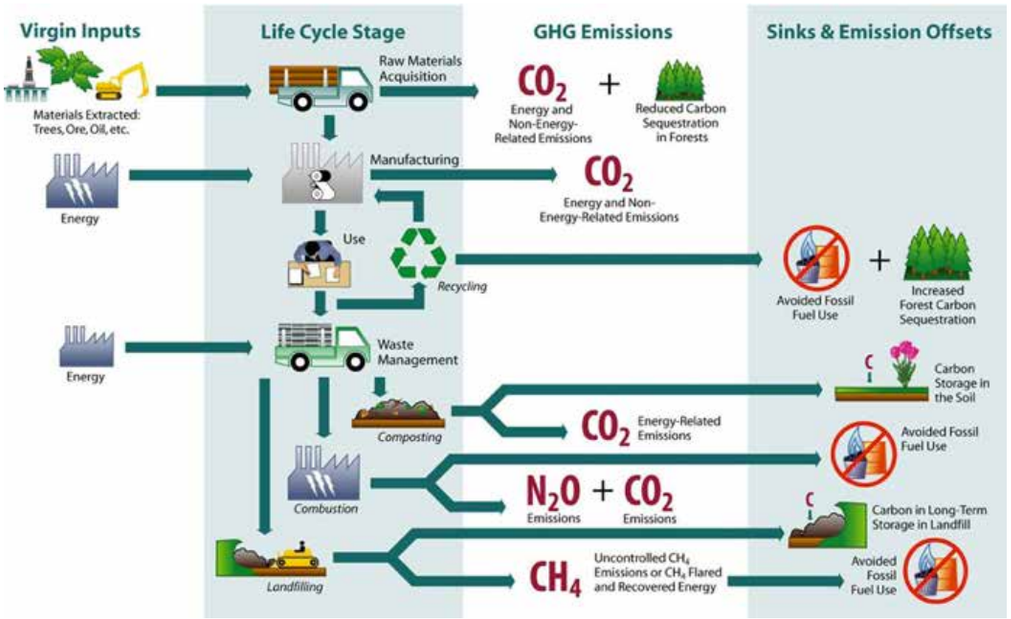
The Way Forward

In order to build upon successes, a suitable platform has to be made as a showcase. The social pressure on resource consumption patterns and the links to climate change have successfully harvested the potential of private sector in a more efficient and resource-conscious generation. While Dubai has yet to stress test its resources against a mega event of the magnitude of the expo in Shanghai, it can boost a unique visionary role.

The value of a carbon neutral event is no longer sufficient. The environmental integrity of such a statement is to be aligned with its operating context and valued for its ability to generate additional value in terms of its socio-behavioral economic model.

Its culture embeds stewardship, and its ambition aims to exceed expectations rather than meeting them. A key value in every event is the data it presents, which is often lost or disregarded. A collegiate approach to events should become a key discipline in project management, establishing the niche market for efficiency within selected industry streams and harmonising the indicators to enhance the planning phases.

The ability to efficiently utilise, not only resources, but also opportunities, may very well be the most valuable legacy. Having been entrusted with a key project objective, the methodological approach should be that of challenging conventional best practices and testing new processes and technologies. Showcases, pilot projects and simple ideas should facilitate the transition towards a more environmentally and socially conscious approach.



ABOUT IVANO IANNELLI

Ivano is the Chief Executive Officer at the Dubai Carbon Centre of Excellence (DCCE) and is widely acknowledged as one of the world's foremost experts in the fields of Sustainability and Carbon Emissions Management.

EXPANDING THE SUSTAINABILITY FOOTPRINT OF MEGA-EVENTS

By HE Reem Al Hashimy

In recent years, sustainability has become a key objective of mega-events. It informs architecture and construction, event operations and management as well as a host of new initiatives that stimulate innovation and generate social impact. With sustainability at the core, today's mega-events are better fit to generate long-term benefits for their host cities and countries, for the nations and citizens that take part in them, as well as for the relevant oversight organisations.

The capacity of mega-events to create significant progress in sustainability is driven by a number of factors. Through construction and operations, mega-events generate substantial physical, economic and social impact at both the host city and the country levels. Their large public appeal helps create considerable public awareness of the challenges, requirements and benefits of sustainability. Finally, the legacy of mega-events increasingly creates new benchmarks driving greater expectations and accountability for future progress in sustainability.

With this understanding, sustainability has been given a central consideration in the design and planning of the Dubai Expo 2020 project since the earliest stages of the bid. Throughout its lifecycle, the Expo project will be a catalyst for new initiatives and investments in sustainability. It will help advance the UAE's objectives towards a green economy, while also harnessing the reach and breadth of the Expo to promote innovation and awareness beyond our shores.

Supporting National Objectives

In the last decade, the UAE has made sustainability a national priority, launching ambitious programmes and policies to diminish the carbon footprint, to diversify energy sources and to reduce energy and water consumption. Federal and local governments are also working towards establishing the UAE as a global pioneer in the green economy, driving development and dissemination of green products and technologies.

The sustainability objectives set by Dubai Expo 2020 will support and complement existing national initiatives. Its public education programmes, the pioneering methods and technologies for green construction and operations as well as the strong emphasis on innovation will form the core of a strong legacy. While creating significant environmental benefits, Dubai Expo 2020 will generate new opportunities for economic and social development through investments in green infrastructure, technologies and services.

Developing Guidelines and Targets for a Carbon-Neutral Expo

The Master Plan of Dubai Expo 2020 itself embodies our ambition to deliver one of the most sustainable World Expos in history. We have developed detailed targets and strategies for the design of infrastructure and buildings, focusing on demand reduction, use of alternative sources, re-use and recycling of energy, water, waste, materials and supplies. This will apply before, during and also after the staging of Expo 2020.

Building on the experience of previous major events, we have set new benchmarks based on more stringent and aggressive criteria. Our aim is to make Dubai Expo 2020 a carbon neutral event by capitalising on available best practices and technologies. Indeed, a preliminary audit of our project has demonstrated that carbon neutrality can be achieved through a combination of new technologies and renewable alternatives as well as carbon trading mechanisms. We will work with all participants to provide the necessary support and to develop a range of incentives and guidelines to implement sustainability measures in all pavilions and make the venue a living example of environmentally sound practices.

Education and Innovation

Sustainability considerations are not limited to the bricks and mortar components of the Expo. Dubai Expo 2020 has gone beyond construction and operations to make sustainability a core topic that will shape content development, public education and the creation of new solutions to outstanding challenges in resource access and management.

The theme 'Connecting Minds, Creating the Future' includes the subthemes of Sustainability, Mobility and Opportunity. It highlights the interdependencies between these three pillars of global development and calls for partnerships that promote innovation and transfer of know-how to ensure better management and access to energy and water. The availability of these resources is the foundation of economic growth and a key enabler of opportunities for human development and well-being. Dubai Expo 2020 will showcase the achievements in sustainability from different parts of the world during the six months event. We have also launched an unprecedented programme – called "Expo Live" – that will foster innovative projects and solutions with clear benefits for communities. The associated Expo Partnership Fund will support innovative approaches to commercial or social development and our Expo network will pair these projects with relevant users and mentors in different regions. In addition to stimulating progress, Expo Live will introduce measurable milestones and therefore new ways to benchmark the impact and the innovation power of the Expo on sustainability.

6. MEGA EVENTS

Towards evaluation and reporting practices

Hannover 2000, the first Expo of the 21st Century, introduced a sustainable development agenda inspired by the outcomes of the 1992 Rio Conference. Aichi 2005 followed suit, promoting a holistic vision of the theme, of the site architecture and of event operations. It also produced a valuable report detailing the environmental initiatives, the figures and the achievements that made the Expo an exceptional instrument for public education on sustainable development. Shanghai 2010 established explicit low-carbon targets and worked in collaboration with UNEP to deliver a comprehensive environmental report ahead of the Expo. Milan 2015 continues to build on this trend and has defined concrete emission targets and adopted international standards for green buildings.

Dubai Expo 2020 is fully committed to build on all of these achievements but also to pursue the holistic approach to sustainability which is required today. While we strive for a carbon neutral Expo, we will also focus on building a legacy that will equally benefit the environment, the economy and our society at large. A collaborative effort amongst mega-events would significantly boost our collective ability to monitor sustainability achievements and further develop international standards and benchmarks. This report, we hope, is the first step towards creating such a platform to share experiences and set new standards for sustainability reporting for mega-events.

ABOUT HE REEM AL HASHIMY

HE Reem Al Hashimy is the UAE Minister of State and the Managing Director of Dubai Expo 2020. In addition, HE Reem Al Hashimy is the chairperson of the Emirates Competitiveness Council, the National Bureau of Statistics and of the philanthropic organisation Dubai Cares.

ENERGY MANAGEMENT FOR MEGA EVENTS

With Sustainability forming one of the core themes of Dubai Expo 2020, the event organisers have made major performance commitments in the area of energy management. These commitments are built on international best practices, emerging technologies and lessons learned from similar large-scale events and aimed to set Dubai Expo 2020 as the benchmark for future global events.

Learning from example:

The Dubai Expo 2020 organisers have sought to comprehensively understand the aspirations, pre-commitments and reported outcomes of previous major global events, in order to build on their successes and push the boundaries of innovation in the area of energy management. Summarising the analysis of four recent mega events, including the 2012 Olympics, 2010 FIFA World Cup and World Expos of 2005 and 2010, the following tables highlight the progress made in the areas of energy consumption, generation and management.

Reducing Energy Consumption Targets, Performance and Initiatives at Mega Events

	World Expo 2005 Aichi	FIFA World Cup™ 2010 South Africa	World Expo 2010 Shanghai	Summer Olympics 2012 London
Building energy use	263,439 kWh of energy was consumed across the site per day, a 25% reduction in energy use against the projected baseline (352,035 kWh).	116,790,402 kWh of energy was reportedly used in total[1], a 70% reduction against the projected baseline of 390,050,946 kWh.	There was no public target or reported outcome for building energy use.	The event met the pre-event commitments of a minimum reduction target in all buildings of 17% and a 44% reduction across the Olympic Village (increasing to 83% with the inclusion of power from the CCHP).
Total carbon emissions (buildings and transportation)	The event produced 31,017 tCO2e from gas, electricity, water and waste, and 13,962 tCO2e from transportation. The achieved outcome was a 30% reduction in Greenhouse gas emissions on the projected baseline (63,911 tCO2e).	340,128tCO2e attributed to accommodation energy use.	There was no public target or reported outcome for green-house gas emissions.	A 58% reduction in carbon emissions from the operation of the venues exceeding the targeted 50%.
Strategy and Initiatives	Initiatives included using the natural movement of air, plants and efficient glass to reduce the need for heating and cooling.	Efficient building heating, cooling and lighting technologies that resulted in a 30% reduction in energy use v business-as-usual.	The organizers sought to obtain the highest Green Building Certificates possible in China. The buildings incorporated innovative efficiency initiatives in the areas of cooling, lighting and energy management.	Buildings were designed for optimal efficiency with low-energy equipment and systems. Approx.15% of energy saving came from design and 5% from efficient operations.

[1] Reverse calculated using the reported carbon emissions of 340,128tCO2e attributed to accommodation energy use and the reported 2,657kl of total diesel consumed during matches (stadiums and broadcasting facilities).

6. MEGA EVENTS

On-site Renewable and Alternative Energy Targets, Performance and Initiatives at Mega Events

	World Expo 2005 Aichi	FIFA World Cup™ 2010 South Africa	World Expo 2010 Shanghai	Summer Olympics 2012 London
Overall Energy Supply	Approximately 6.6MW of power was generated on site and approximately 670,000 kWh of energy was produced off-site at wind farms.	"Electrawinds" donated 1.8MW electricity to the Nelson Mandela Municipality, thereby offsetting 1,180 tCO2e for the event meeting the target to only use energy within the stadiums that came from "renewable" or "green" sources.	It was reported that the total on-site renewable or alternative energy installed power capacity was approximately 75MW (accounting for the initiatives below).	10.8% of the event's energy requirement was generated by renewable energy - below the pre-event target of 20%.
Solar & Wind Power	Solar energy generated through various technologies contributed 2,357 kW, on-site wind contributed 1,982 kW of power.	There was no public target or reported outcome for solar or wind power, although as seen above, wind power did form part of the eventual energy supply solution.	The total on-site solar installed power across the site was 4,687 kW, generating 4,050MWh of electricity and thermal heating, provided 52% of annual domestic hot water for the Expo Centre, with an annual reduction of 156 tCO2e.	There was no public target for renewable energy although photovoltaic panels and on-site turbine (capacity of 35kW) were installed
Waste to Energy	A demonstration plant, generating 2,200kW of electricity at Japan Pavilion Nagukte was installed, processing a total of 587t of garbage and 3,360kg of plastic bottles.	Not Applicable	Not Applicable	A 3MW thermal woodchip boiler was installed on the Olympic Park reducing carbon emissions by 1,000tCO2e per annum.
Alternative fuels (CCHP, hydrogen fuel cell) and heat pumps	Alternative fuels were used for transport as well as some structures and buildings, including a hydrogen fuel cell bus.	Not Applicable	Water-source heat pumps and one ground heat pump were installed, with a combined cooling capacity of 64.3MW.	A 3.3MW natural gas-fired combined cooling, heat and power plant was installed in the Olympic Park, reducing carbon emissions by 2,200 tCO2e per annum.

Summary of Awareness and Education at Mega Events

	World Expo 2005 Aichi	FIFA World Cup™ 2010 South Africa	World Expo 2010 Shanghai	Summer Olympics 2012 London
Strategy and Initiatives	Visible solar panels onsite; live displays showed how much renewable energy was being produced during the Expo; interactive exhibits allowed visitors to generate electricity from litter and waste. Educational campaigns conveyed environmental themes, amongst them an Eco-Money activity to promote environmental behaviours. Eco-Money was issued for each environmentally responsible action by visitors. These were also earned for offsite activities such as the reduction of shopping bag use or the use of public transport. Eco-Money could be exchanged for eco-goods and tours.	Organisational and behaviour change was a major focus of the World Cup energy conservation approach. Staff were trained to conserve energy during the event. Some awareness initiatives implemented included the demonstration of renewable energy technology used for educating visitors. Furthermore, solar-operated TV viewing points were installed in 35 villages around South Africa and Namibia to enable fans in regions without electricity to watch the games.	A decommissioned coal-fired power station onsite was transformed into a renewable energy education centre. The 'greening' of the Shanghai power sector with renewable energy in preparation for the World Expo drove a reduction in coal use from 64.5% to 51.5% during 2001-2007. The Expo Exhibition and Convention Centre is now used as a sustainable exhibition space, hosting events such as the 2013 International Green Building & Energy Efficiency Exhibition.	The major education program for the Olympics was the 'Get Set' campaign, delivered to over 20,500 schools in the UK. The program provided free interactive learning resources such as films, games, activity ideas and fact sheets to help young people 'explore Olympic values'. The educational materials covered energy management, renewable energy and carbon reduction targets.

A key finding of the analysis of these events is that the recent previous World Expos comprehensively measured and reported their energy performance. Whilst a positive move in itself, the decision to do so however, was not shaped by publicly-shared commitments to targets.

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The 2012 London Olympics adopted a rigorous approach to energy performance management and a commendable strategy of transparent measurement and public reporting.

FIFA is yet to adopt the practice of setting clear energy performance targets for World Cup competitions, although good progress was made at the 2010 event by (at least) setting design commitments for individual venues.

Reducing the amount of energy used in the construction, operation and decommissioning of buildings and infrastructure is the foundation for a successful approach to managing energy use at a global event. Renewable energy technologies such as solar and wind can provide visible clean energy solutions at the event site. Such initiatives, along with accompanying awareness and education campaigns, can capture the attention of the visitors and participants, which in turn supports and facilitates lasting behavioural changes, a legacy impact that continues long after the event itself is over.

The Dubai Expo 2020 team has carefully examined the energy management measures employed at the most recent global mega events, including targets and performance outcomes. Doing so has enabled the development of a thorough and detailed strategy, built around the three pillars of reduced energy consumption, on-site renewable energy supply and awareness and education.

This has allowed the Dubai Expo 2020 organisers to set aspirational targets for energy consumption and renewable energy supply at the earliest stage of the event planning that will ultimately demonstrate global leadership for mega events. For the first time in the history of World Expos, Dubai Expo 2020 is setting clearly defined sustainability targets and guidelines.

Dubai Expo 2020 Team

EXPO MILANO 2015 AND SUSTAINABILITY

Building upon the 1994 BIE Resolution that called for a key role of sustainability in World Expos, Expo Milano 2015 has made significant commitments during and after the bid phase, as illustrated in some of its official statements:

"Sustainability of Expo Milano 2015 is not just an objective but part of the Event itself, an element for the involvement of all of Participants."

Application for Registration to the BIE, 2010

"Expo Milano 2015 will strive to guarantee the highest environmental standards for the Event. Such an ambitious commitment will require the utmost involvement of all participants, who will be called upon to ensure the highest standards of environmental performance through all phases of the Expo project."

International Participants Guide, 2011

"It will be an 'innovative' Expo because in all of the forms in which it is represented it will make clear to visitors and to the international community the essence of a new Expo concept: thematic, sustainable, technological and visitor-centred."

Theme Guide, 2012

A holistic approach to Sustainability

As Organiser of the Expo Milano 2015 we believe that sustainability and its application to an event such as the World Expo has a broad meaning which encompasses environmental, safety and social aspects, corporate governance and ethics, human resources and several intangible elements including the legacy beyond the event.

Implementing sustainability objectives means trying to act, as far as it is reasonable, in line with the expectations of the diverse stakeholders of the event throughout its life-cycle, to discuss and propose solutions through innovative, sustainable practices and new ways of collaboration.

The design, construction and organisation of an Expo affect environmental resources and the locations in which the event is held. Therefore, in the preparation of Expo Milano 2015, sustainability is not only considered a goal, but also one of the main contents of the project itself.

Furthermore, the theme of Expo Milano 2015; 'Feeding the Planet, Energy for Life', addresses the major issues regarding the fundamental topic of nutrition and sustainable development, and explores the relationship between food production processes and economic prosperity, natural resources quantity and availability and, finally, social equity.

Expo Milano 2015 considers environmental and social aspects as interdependent and equally important. Thus, it takes into account the timeframe of the event and integrates sustainability principles and criteria into three key phases with associated tools and commitments from stakeholders: planning and designing, management and closing and post-event. Some of the major initiatives that we have adopted to date are summarised below.

LEED® Standards

The design and construction phase of the site are based on the US GBC LEED® (Leadership in Energy and Environmental Design) protocol 'Green Neighbourhood Development 2009' (LEED® ND). They integrate the principles of smart growth, urbanism and green building into the first national system for neighbourhood design. A recent assessment, by an independent third party, indicates the chance to achieve the LEED® ND certification for the Exhibition Site (LEED® protocols are generally applicable to permanent buildings). In addition, Expo Milano 2015 aims to achieve Silver level LEED® certification for the permanent building 'Cascina Triulza'.

To encourage participants to adopt some of the criteria included in the LEED® protocols for temporary buildings, we have issued the guidelines 'Sustainable Guideline Solution: Design, Construction, Dismantling and Reuse'. These cover different environmental aspects and strategies throughout the lifecycle of the event: energy, materials, construction technology, waste, water, soil, air quality, including alternative solutions to reuse, recycle and disposal of building materials. These voluntary guidelines provide references and suggestions to achieve better environmental performance in the design and construction of temporary buildings and exhibition spaces. Each participant may chose different solutions based on the exhibition strategy and plan.

Green Procurement

Following European and Italian legislation and BIE Special Regulations, we have developed requirements for suppliers and partners and voluntary guidelines for green procurement for participants. The goal is to minimise demand on energy and other resources, to promote the use of renewable energy, to implement a food and beverage system that uses products and services with low impact on the environment and on the supply chain.

Carbon Emissions

An inventory for GHG emissions is under preparation based on UNI EN ISO 14064 standard, which consider the following emission categories:

a) from site construction, dismantling and event management
b) from major events organised during the preparation phase (late 2012 - beginning 2015)

In addition, Milano Expo 2015 is committed to offset its carbon footprint by contributing to local projects in the areas of energy efficiency, renewable sources, forestry and sustainable agriculture. Targeted projects are managed by public authorities, involve local stakeholders, are transparent and rely on international standards and best practices.

SMART CITY Technologies

State-of-the-art exhibition and 'Smart City' technologies in different domains, such as energy, communication, health services, site accessibility and mobility will offer participants and visitors a wide range of services that promote sustainability while facilitating participation before and during the event. We recently launched an independent study that will evaluate the qualitative and quantitative impact of these new solutions on the sustainability of the site and of the broader metropolitan area, including functionality, environmental impact and stakeholders' satisfaction. The methodological approach of this study will also be applicable to similar contexts in the future.

Managing and Monitoring

The Integrated Management System provides the framework of reference to analyse, manage and monitor the Expo's sustainability objectives and actions. It is based on different standards:

- Eco Management and Audit Scheme (EMAS): a voluntary instrument created by the European Union (EC Regulation - 25 November 2009, n. 1221/2009), to assess and improve environmental efficiency and to provide information on environmental performance;
- ISO 20121: specifications for a sustainability management system for events;
- Global Reporting Initiative (GRI): for the periodical release of a sustainability report as part of a broad policy of accountability and communication.

These plans and actions require significant effort and support from all Expo stakeholders: countries, international organisations, partners, suppliers, NGOs as well as visitors. We hope they will all join this exciting challenge to establish higher performance targets and set another benchmark for future mega-events.

Expo Milano 2015 Team

6. MEGA EVENTS

SUSTAINABLE DEVELOPMENT IDEAS AND GREEN ENERGY TECHNOLOGIES OF WORLD EXPO SHANGHAI 2010

World Expo Shanghai 2010 presents a very good opportunity for the city to define in further details its environment protection objectives and actions. And Shanghai expedites its ecological protection and construction by leveraging talents, resources, finance and policies to promote balance in economic, social and environment sustainability, thus making it a model of urban sustainable development.

Expo Shanghai reiterates its sustainability guidelines in the site planning, construction, operation and post-utilisation and highlights urban responsibilities in environment changes. Efforts have been made in promotion of carbon mitigation and ozone layer protection. We have also adopted many resource-efficient and environment-friendly technologies and measures such as solar photovoltaic power generation, river water/ground-source heat pump, ice storage air-conditioning, semiconductor illumination, rainwater retrieval, new energy vehicles, green material and constructions, and green landscape designing to explore new model of environment-friendliness and low-carbon development. And reconstruction of old factory buildings, protection of legacy constructions of high historical values, construction of an Expo wetland park, and establishment of the Urban Best Practice Area all provide room for utilisation in future. Practice has proved that urban sustainable development guidelines including green energy technologies have been carried through and promoted during post-Expo period. More over, further publicity of ecological civilisation as well as other education and practice activities have improved awareness of the government, enterprises, social organisations and the public and build up consensus on environment protection, sustainability and urban development.

Expo Shanghai Group
July, 2013

EXPO LIVE: A COLLABORATIVE PROGRAMME FOR INNOVATION AND SUSTAINABILITY

The challenge of global sustainability will increasingly require innovations from all corners of the world and, therefore, it will also require us to share our knowledge across continents and communities.

The World Expo is unique in that it provides a platform to forge these types of diverse partnerships; bringing experiences and ideas from around the globe in a celebration of mankind's ingenuity. Drawing on this exceptional ability, Dubai 2020 has introduced a new programme, Expo Live, which will rely on the international Expo community to inspire and drive practical progress in global sustainability.

Whilst the Expo will last only 6 months, Expo Live has already commenced and will continue until 2020 and beyond. It will bring together diverse groups and support projects that can provide concrete solutions to some of the major challenges defined by the Expo's sub-themes of Mobility, Sustainability and Opportunity.

The programme has separate components: the Expo Live Network, Events, Challenges and Fund. The events and the partnership network will help define the key challenges and solicit projects with the potential to deliver significant impact to our communities. The events and network will form a channel to share expertise required to support and promote projects selected for funding by the Expo Live fund. This 100 million euro fund will assist in translating projects into real solutions and help share them across our communities.

Dubai Expo 2020 will experiment with new and emerging technologies across the Expo site and will also promote education for sustainable development through exhibitions and events during the Expo. Expo Live embodies the commitment of Dubai Expo 2020 to deliver on sustainability objectives by making a long-term commitment in the form of a well-funded operational programme for innovation and collaboration.

EXPO 2020
DUBAI, UAE
CANDIDATE CITY

Dubai Expo 2020 Team

CONNECTIVITY MEANS EFFICIENCY

By Paul Zissermann

Harnessing geographic location and state of the art infrastructure; a logistics and transportation system to reduce the environmental footprint of mega-events.

> “Dubai International Airport is now the second busiest in the world in terms of international passenger traffic”

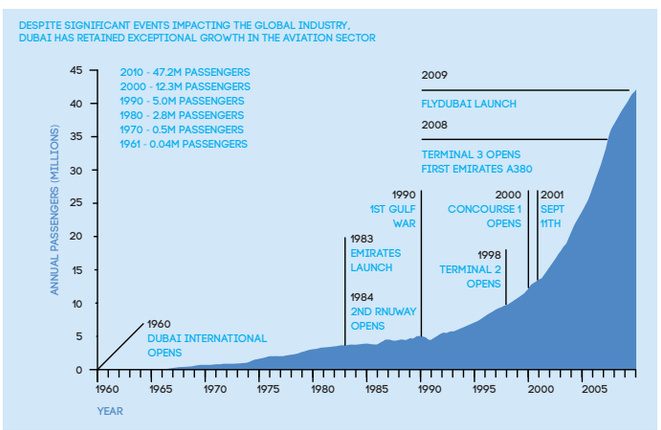
Three of the greatest strengths of Dubai’s bid to host the Dubai Expo 2020 are its geographical location, its state-of-the-art airport, and the connectivity offered by the airlines serving Dubai; including Emirates, now the largest international airline in the world. Together, these three factors give Dubai’s bid an enviable advantage, allowing the anticipated 25 million visitors to the 2020 Expo to travel to and from the event more quickly and efficiently. In turn, easier and direct access to the venue translates into better environmental performance compared to locations that do not have the same degree of connectivity.

A geographical hub

Many would argue that the city’s rapid development has been a result of its location at the crossroads of historic trade routes between Europe, Asia, Africa and the Far East. This advantage was clearly realised by Dubai’s leaders in the early days of its development, when His Highness Sheikh Rashid bin Saeed Al Maktoum decided to construct the Jebel Ali Port and Free Zone in the early seventies. The Jebel Ali Port is now the largest man-made harbour in the world and the largest port between Rotterdam and Singapore. It is also the largest and busiest regional port in the Arabian Gulf. Jebel Ali is arguably the main economic engine of Dubai, responsible for over half of Dubai’s export movements and contributing some 25% to Dubai’s GDP.

Breaking records

The government’s support and investment in the aviation sector has followed the same pattern with spectacular success. Since welcoming its first flight in 1960, Dubai International Airport is now the second busiest in the world in terms of international passenger traffic, according to a 2013 report from the Airports Council International. It is now due to surpass London’s Heathrow Airport in the top position by 2015, if not earlier. In 2012, Dubai Airport handled 57.7 million passengers, more than double the 24.8 million handled in 2005. Alongside the Dubai government’s investment in Emirates Airline, the rise of Dubai as an aviation transport hub cannot be ignored. Emirates itself was only established in 1985 with two leased aircraft, and is now the largest international airline in the world (in terms of international passenger-kilometres flown).



Dubai Airports, 2011: ‘Connecting the World Today and Tomorrow - Strategic Plan 2020’

Formula for success

It has been estimated that approximately two-thirds of the world's population live within 8 hours flying time from Dubai, while one third live within 4 hours flight time. Whether as a connecting hub, or as a final destination, Dubai has an unrivalled advantage of bringing visitors to, or through, its doors. As a result, the International Air Transport Association (IATA) has concluded that the UAE is the most connected country in the world, due largely to Dubai's growing aviation sector.

Altogether, over 150 airlines provide services to 220 destinations from Dubai, directly serving over 55 cities with populations of over 10 million people.

(Dubai Airports, 2011)

Streamlined for efficiency

In terms of CO_2 emissions efficiency, let us consider eight tourists from different global locations; originating in North America, South America, Europe, Africa, the Middle East, India, China and Australia. Each of these eight travellers can fly directly to and from Dubai. If you were to take a city at an end-point destination such as South East Asia or South America, only four or five of these travellers (at best) would be able to reach their destination directly. This lack of connectivity results in much longer flying distances, longer travel times and increased fuel consumption per passenger – with associated increases in overall greenhouse gas emissions from the sectors flown.

Time zone advantage

Coupled with the geographical advantage of Dubai as an aviation hub, is its location in regards to time zones. The 24-hour operations of its airport allow for flights to arrive in two 'peaks', ensuring convenient connections and shorter travel times. For example, passengers arriving from the Far East and Australasia in the early morning have only a few hours of waiting time for connecting flights to Europe, Africa, India or elsewhere in the Middle East. Likewise, flights arriving late at night from Europe have short connection times to join flights departing Dubai in the morning for most other onward destinations.

> "Approximately two-thirds of the world's population live within 8 hours flying time from Dubai"

Engineered for efficiency

In addition to the efficiencies of Dubai as a central geographical hub are the environmental performance and fuel efficiency of the modern, efficient aircraft operated by its two main airlines – Emirates and flydubai. Emirates boasts a fleet of over 200 aircraft, largely made up of new, efficient wide-bodied commercial jets such as the Airbus A380 and the Boeing 777-300ER. Apart from offering a superior on-board travel experience, these aircraft provide far better fuel efficiencies per passenger kilometre, especially when operated at passenger load factors averaging around 80%.

Combined with a host of operational measures to further maximise efficiency – such as single engine taxiing, continuous descent on approach and flexible 'user-preferred' routing to take advantage of (or avoid) climatic conditions such as high altitude winds – Emirates reports fuel efficiency as low as 4.11 litres per 100 passenger kilometres (L/100PK).

Due to Dubai's superior aviation infrastructure, its geocentric location and its modern, eco-efficient airlines, it appears clear that the overall carbon footprint associated with the anticipated 25 million visitors attending the Expo 2020 in Dubai would be likely to be significantly less than if it were hosted in other cities that lack the same degree of connectivity. It is important, therefore, that 'considerations' towards sustainability, should also include benchmarking the environmental performance of an event based on the connectivity and infrastructure being offered by the host city.

ABOUT PAUL ZISSERMANN

Paul is an independent sustainability advisor based in Dubai. With over 20 years experience in the global environmental and sustainability field, he has worked with governments, large corporations, NGOs and international consultants in a wide range of industry sectors – from aviation to infrastructure to natural resources. Prior to starting his own advisory service, Paul was the Manager of Environmental Affairs with Emirates Airline and Group.

6. MEGA EVENTS

ENERGY STRATEGY FOR DUBAI EXPO 2020

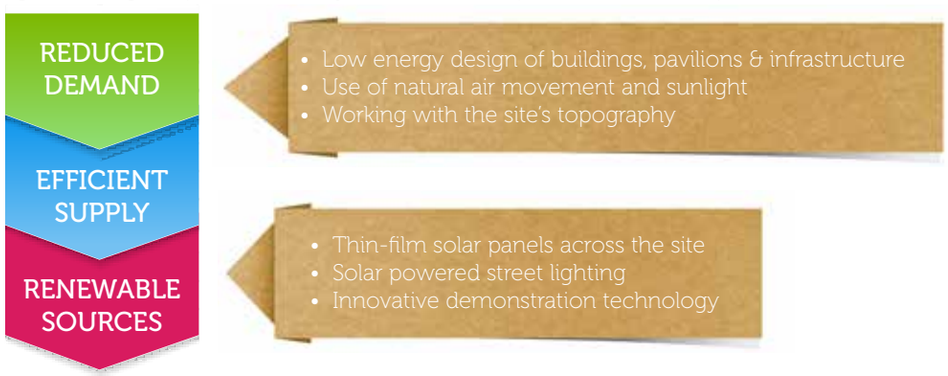
> “Dubai Expo 2020 forecasts a 30% reduction in operational energy consumption”

Seamlessly integrating three sub-themes—mobility, sustainability and opportunity—within the vision of ‘Connecting Minds, Creating the Future,’ the essence of the Dubai Expo 2020 master plan revolves around minimising energy consumption, maximizing operational efficiency and using renewable energy sources.

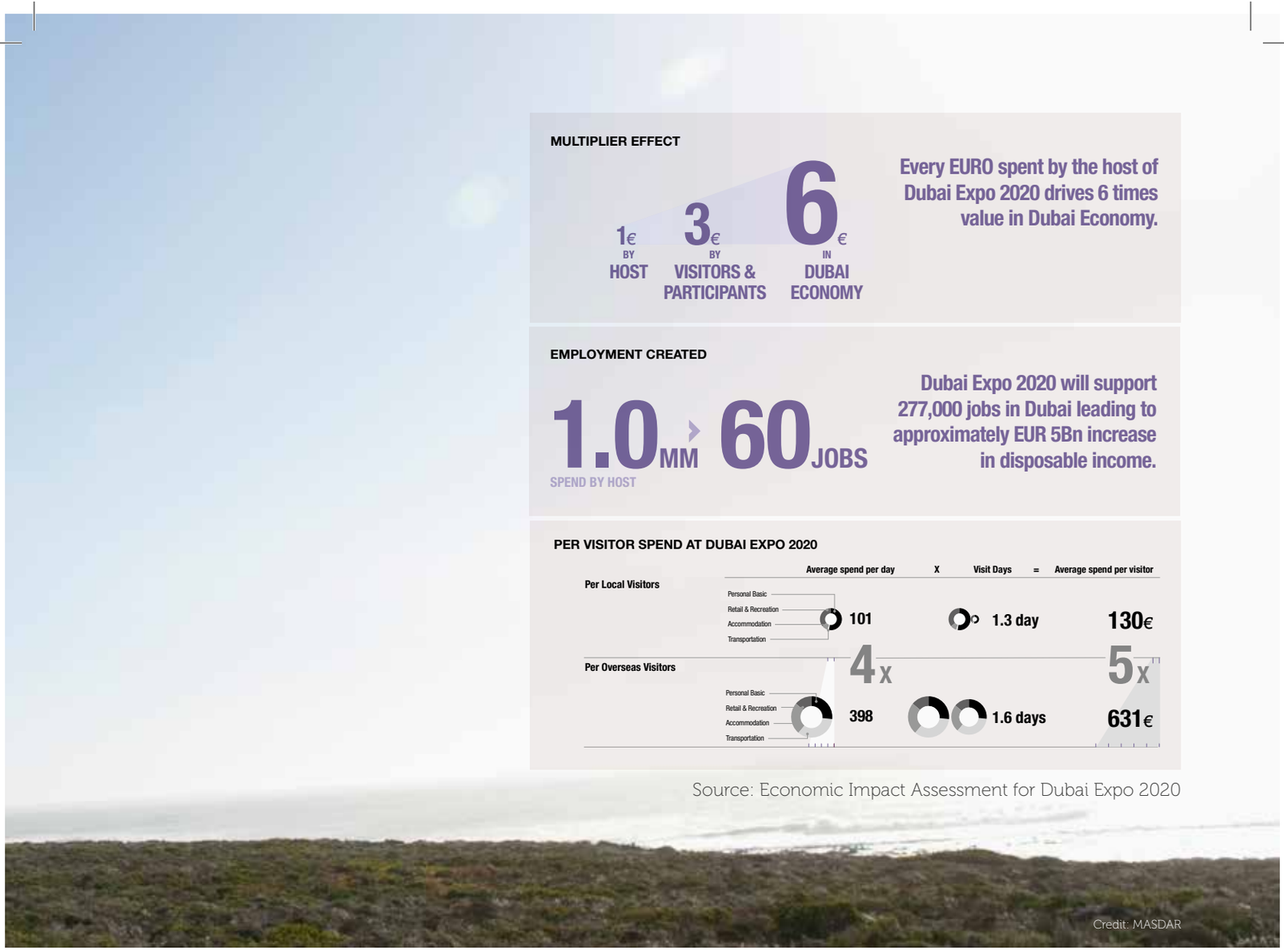
Dubai Expo 2020 has clearly defined targets to achieve exceptional performance in all areas of sustainability, across all phases of the event; design and planning, construction, operation and transformation to legacy. The independent building ratings schemes of the US Green Building Council’s Leadership in Energy and Environmental Design (LEED®), and Abu Dhabi Urban Planning Council’s Estidama Pearl Rating System (PRS) will be the benchmarks by which the Expo will be transparently monitored.

Driving the Expo’s Energy Strategy are the guiding principles of sustainability; demand reduction, maximising efficiency of supply and use of renewable resources.

Figure 1, Guiding Principles of Sustainability and their Practical Implementation in Dubai Expo 2020



EXPO 2020
DUBAI, UAE
CANDIDATE CITY



Source: Economic Impact Assessment for Dubai Expo 2020

Credit: MASDAR

> “50% of energy needs are to be supplied from renewable sources.”

Energy Demand Reduction

For the operational period of Dubai Expo 2020 the organisers are forecasting a 30% reduction in energy consumption against the estimated business-as-usual (BAU) scenario of 330,000MWh. The energy-efficient (EEF) scenario being adopted is based on the application of carefully planned strategies, guidelines and systems that are forecasted to reduce the energy consumption to 230,000MWh over the Expo period.

Identifying simple yet practical strategies in the forward planning can ensure energy conservation, visitor comfort and cost savings. For example, holding the Expo during the cooler months of the year (October – April) will naturally reduce the demand for energy intensive air conditioning. In addition, the Expo master plan will ensure buildings and pavilions are located and designed to take advantage of the natural environment.

Renewable Energy Supply

A key ambition for Dubai Expo 2020 is to generate 50% of the forecasted operational energy demand, 115,000 MWh, from renewable sources.

Feasibility studies examined a wide range of renewable energy technologies, however a ‘solar centric’ strategy has been selected to take advantage of the local environment. The strategy concentrates on the use of highly efficient thin-film solar panels, incorporated into the walls and roofs of buildings, shading, lighting, and walkways across the site. Based on an EEF scenario, around 350,000 square metres (m2) of solar panels will be needed to produce the electricity required to meet the energy demand target.

In a BAU scenario, where no energy efficiency measures have been applied, approximately 500,000m2 of solar panels would be required to achieve a target of 50% of the Expo’s energy needs from renewable sources. It is crucial, therefore, that the energy strategy focuses firstly on reducing energy consumption, and then the provision of renewable energy.

In total, 44MW of solar power will be installed for Dubai Expo 2020, more than nine times the capacity installed at the 2010 Shanghai World Expo (4.7MW) and a new world benchmark for renewable energy generation at global events. Dubai Expo 2020 will demonstrate that it is possible to integrate local energy sources within the built environment without the need for large offsite areas.

While the energy strategy focuses primarily on solar, the viability of other sources of renewable energy, such as geothermal, will be assessed at the next stage of planning.

6. MEGA EVENTS

Sustainability Targets and Design Guidelines

In order to minimise the energy demand and carbon footprint of the Expo, pavilions and buildings will be designed to maximise energy efficiency. Challenging 'sustainability targets' have been developed for participants and designers to achieve in the preparation, construction and operation of the Expo. A summary of the targets is provided below;

		REFERENCE
Maximum Peak Load	Pavilions - 70 W/m2	LEED® 2009 for New Construction and Major Renovations: • EA Prerequisite 2: Minimum Energy Performance; • EA Credit 1: Optimise Energy Performance. Estidama Pearl Building Rating System: • RE-R1: Minimum Energy Performance; • RE-1: Improved Energy Performance. Energy Improvement over ANSI/ASHRAE/IESNA Standard 90.1-2007.
	Expo Village - 90 W/m2	
Building Integrated Renewables	5% of building energy demand	LEED® 2009 for New Construction and Major Renovations: • EA Credit 2: On-site Renewable Energy. Estidama Pearl Building Rating System: • RE-6: Renewable Energy
Interior water consumption	25% reduction from business-as-usual[1]	LEED® 2009 for New Construction and Major Renovations: • WE Prerequisite 1: Water Use Reduction; • WE Credit 3: Water Use Reduction. Estidama Pearl Building Rating System: • PW-R1: Minimum Interior Water Use Reduction; • PW-1: Improved Interior Water Use Reduction.
Waste	85% waste diversion rate from landfill (construction, operation and deconstruction)	Estidama Pearl Community Rating System: • SM-R2: Basic Construction Waste Management • SM-R3: Basic Operational Waste Management • SM-5: Improved Construction Waste Management • SM-6: Improved Operational Waste
Recycled content	20% of construction cost	LEED® 2009 for New Construction and Major Renovations: • MR Credit 4: Recycled Content Estidama Pearl Building Rating System: • SM-10: Recycled Materials; • SM-11: Reused or Certified Timber.

[1] Current business as usual is assumed at 50L/person/day for pavilion staff and 20L/person/day for Expo visitors

The Targets are based on references from the following internationally recognised sustainability rating systems;

- LEED® 2009 for New Construction and Major Renovations
- LEED® 2009 for Neighbourhood Development
- Estidama Pearl Building Rating System (Design & Construction) V1.0
- Estidama Pearl Community Rating System (Design & Construction) V1.0.

The Targets have been set to achieve an appropriately high rating when considered against the above systems. Design Guidelines have also been prepared to assist the participants and design teams to meet the Sustainability Targets.

Awareness and education

Maximising sustainability awareness and facilitating education is a key objective for Dubai Expo 2020. Developing visitor understanding, appreciation and contribution to the responsible use of energy resources during the Expo leads to habitual changes that have a lasting impact on the environment.

'Best Practice Areas' will showcase examples of projects from around the world to the general public, whilst the design and construction of the pavilions, buildings and public realm will incorporate innovative technologies as a clear demonstration of how the guiding principles of sustainability can be practically and cost-effectively applied.

As well as clearly visible displays, a smartphone application will be developed to display real-time information on the energy performance of the pavilions and buildings.

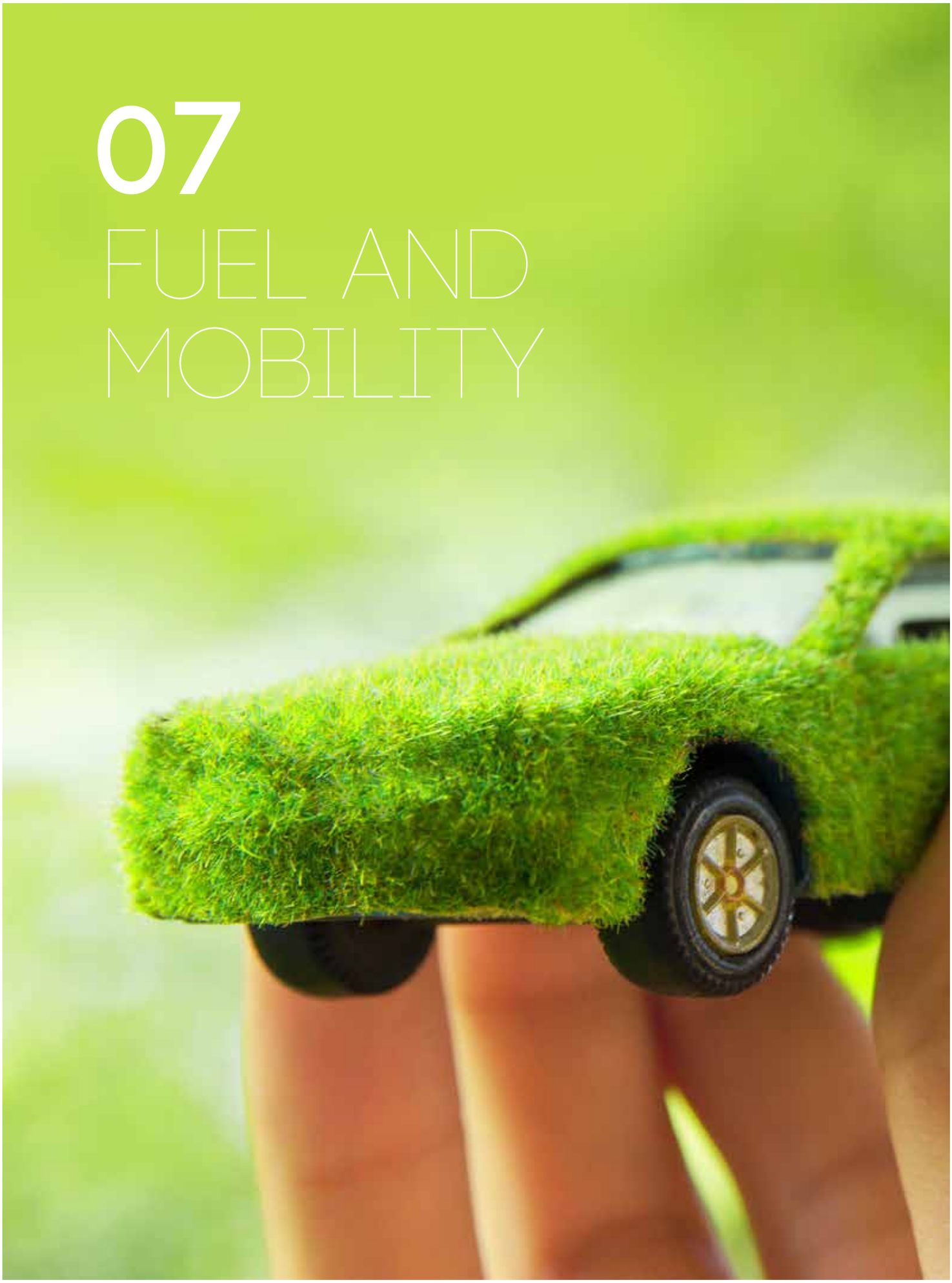
Awareness and education are key means through which the event can help to secure a sustainable energy legacy for visitors, stakeholders and communities on a local and international scale.

> "For the first time in Expo history Sustainability Targets have been set, against which energy performance and management will be measured and reported."

In the master planning for Dubai Expo 2020, the organisers have looked closely at past global events of a similar scale to assess the approaches taken towards energy demand and supply. Dubai Expo 2020 has taken lessons learned from these events and sought to take the energy management and performance at global events to the next level. Through innovation and sensible forward planning, Dubai Expo 2020 will demonstrate that a practical sustainable energy strategy can be adopted that achieves challenging conservation targets during the event and provides a lasting legacy in terms of awareness and education, whilst maintaining reasonable levels of cost. Dubai Expo 2020 seeks to become the global benchmark by which all future global events will be compared.

Dubai Expo 2020 Team

07
FUEL AND MOBILITY



It is our honour to extend our support to the 'State of Energy Report', an important document that underlines the efforts taken by Dubai's public and private sector entities to drive sustainable development.

As the force 'behind every successful journey', ENOC has consistently focused on promoting sustainable development initiatives – be it through helping popularise the use of compressed natural gas as automotive fuel or introducing the very first green fuel station.

Our initiatives are led by the 'green economy for sustainable development' vision outlined by His Highness Sheikh Mohammed Bin Rashid Al Maktoum, UAE Vice President and Prime Minister and Ruler of Dubai.

We will continue to extend our unwavering support to drive sustainable growth by promoting energy use efficiency and exploring cleaner and greener options for the benefit of our future generations. We remain committed to integrating sustainability as central to every activity we undertake.

SAEED KHOORY

CHIEF EXECUTIVE OFFICER

EMIRATES NATIONAL

OIL COMPANY (ENOC)

CHAPTER 7
FUEL AND MOBILITY: A SNAPSHOT

By Waddah S. Ghanem,
Chief EHSQ Compliance Officer and Group EHSQ Compliance Director of Emirates National Oil Company (ENOC)

Over the past 30 years, Dubai and the United Arab Emirates have invested greatly in infrastructure projects, making the country one of the most well connected in the Arab world. The quality of infrastructure not only means faster and more effective transport of goods and people, but also helps reduce the congestion on roads as well as pollution per kilometre driven. As the force 'behind every successful journey,' Emirates National Oil Company (ENOC) has been at the forefront of bringing a culture of 'green mobility' through solutions that include the use of cleaner fuels that, in turn, contribute to enhancing the efficiency of the transport infrastructure.

Mass Transportation: An Efficient Solution

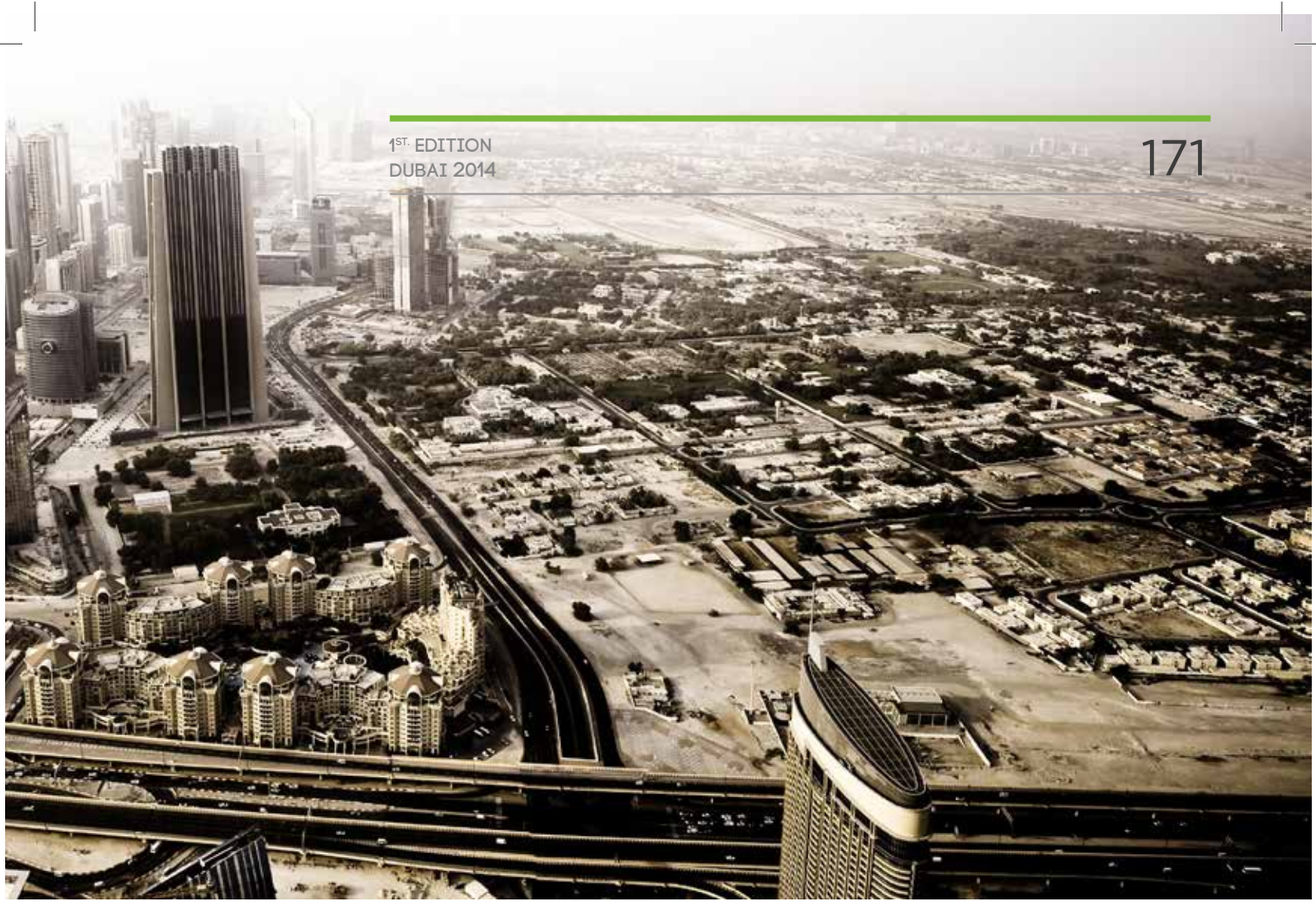
Dubai has set a regional trend in enhancing the efficiency of mass transit systems with the introduction of the Dubai Metro in 2009 by the Roads & Transport Authority (RTA). Connecting key areas in the most populous neighbourhoods in Dubai, the Metro is now the world's longest driverless metro network and carries an average 360,000 passengers per day.

Even if we assume a conservative three-person-per-car scenario instead of five travelling in an average saloon car, this still translates to 120,000 fewer cars on the road. Dubai Metro was planned as part of the 'Strategic Integrated Master Plan' aimed at increasing the share of public transport from 6% to 30%, by the year 2030. In 2012, the Metro served a total of 178 million commuters, and considering the causal relationship between usage and emissions, this led to a reduction of the city's carbon footprint by as much as 394 tonnes daily.

To put the success of Dubai Metro in context, in terms of road transportation, in 2009 some 70 million journeys were undertaken by taxis in Dubai, carrying approximately 140 million passengers. This is similar to the over 120 million passengers who used public buses during the same period. These modes of public transport were either gasoline or gas oil run vehicles. This presents a strong opportunity for the conversion of many of these vehicles to compressed natural gas (CNG); significantly reducing CO_2 and other greenhouse gases (GHG) emissions. At a national level, in 2009, the development of Etihad Rail, a USD 40 billion multi-functional rail system was also rolled out, primarily aimed at moving dry cargo and goods through a network that will eventually run over 1,200 km. One train can substitute for up to 300 lorries, improving safety, whilst also reducing congestion and pollution. It is estimated that a train carrying the same tonnage of goods as lorries can reduce CO_2 emissions by 70 to 80%. Passenger trains, which will come in the second phase, are expected to carry up to 16 million passengers per year by 2020. The development of Etihad Rail is on schedule, and should witness the first train running from Habshan to Ruwais by the end of 2013.

The benefits of efficient mass transportation can be further realised through the development and popularising of engines that run on cleaner fuels. ENOC took the initiative, as early as 2006, to popularise CNG as an automotive fuel. EMGAS, a subsidiary of ENOC, launched CNG in Dubai through a pilot project with RTA. Initially, diesel-operated wooden abras (water taxis) that work on the Dubai Creek were converted to operate on CNG, underlining its effectiveness as an environment-friendly fuel that is ideal for all types of vehicles. Aimed at reducing air emissions, noise and water pollution, despite the project initially facing technical challenges, the water taxi prototype was launched successfully in September 2009. It helped in saving fuel costs by 30% and expanded the lifetime of engines.

EMGAS also introduced CNG to fleet users such as Dubai Municipality, DP World, Emirates Group, Transguard and DEWA, among others, and also developed the first CNG mobile filling



station in 2007. EMGAS has plans to deliver CNG to the customers' premises by drawing on the concept of dedicated CNG Daughter Stations.

In Abu Dhabi, a CNG project is now being implemented. Currently, Abu Dhabi's Department of Transport records that more than 3,000 public transport vehicles are adapted to run on CNG. Abu Dhabi National Oil Company (ADNOC) has also invested in the infrastructure to ensure there are enough filling stations to support the additional demand for such vehicles. Given the size of population, this is a huge achievement for the UAE.

Waste-to-Energy

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

Further promoting the expansion of the CNG fuel penetration in the UAE, EMGAS hosted the Compressed Natural Gas – Natural Gas Vehicle (CNG-NGV) ANGVA (Asia Pacific Natural Gas Vehicles Association) Forum 2013 focused on promoting sustainable growth and cleaner air through the use of CNG-NGV. Emirates Standardisation and Metrology Authority (ESMA) was also involved in the event, and made a keynote presentation on the standards being developed for vehicle CNG fuel systems. A strong platform now exists for safe and reliable CNG vehicles to come into the market, and studies on alternative fuels are being undertaken.

Strategy for Sustainable Growth and Development

In 2011, the UAE ranked third in the world with 16 tonnes of oil equivalent per capita (toe/capita) energy consumption. By comparison, the USA ranked ninth, with 7.2 toe/capita. This demonstrated the need for the UAE to exercise efforts to reduce energy consumption through rationalisation, economisation, and building efficiencies.

Dubai's recent focus has been on sustainable growth with an ambitious and steadfast plan. This was reflected in the undertaking of a major study, not only to quantify the carbon emissions in the city, but also to formulate policies for every sector including buildings, industry and transportation. Named the Monitoring, Reporting and Verification (MRV) 2012 project, it was mandated by the Dubai Supreme Council of Energy (DSCE), and executed by the Dubai Carbon Centre of Excellence (which is now expanding to cover the entire UAE). More than 24% of the emissions identified in the MRV 2012 baseline study were attributable to transportation in Dubai in 2011. This is in addition to the directives of the DSCE in driving the use of more effective and efficient resources from production, consumption and the innovative strategy to minimise waste through waste-to-energy technology.

The challenges are manifold, primarily owing to the use of less efficient technologies in certain sectors, and comparatively cheap tariffs and subsidisation of motor fuels. However, policies are being designed to bring about awareness on the importance of sustainability.

7. FUEL AND MOBILITY

Balancing the Growth in Demand

Both private and commercial vehicles are expected to increase in numbers to meet the population growth between 2013 and 2020. Beyond a projected steady rise over the next seven years, this may increase even further if Dubai secures its bid to host World Expo 2020. Besides the many attributes that make Dubai an ideal candidate city to host the global event, including the robust business environment and world-class hospitality, the city is also strategically located and connected very well with major cities around the world through its international airports. Domestically, the UAE has an efficient road transport network, facilitating smooth inter-Emirate travel.

Efficient multi-model environmentally friendly solutions are vital to Dubai's future transportation policy. While Dubai has tried to implement a fair tariff system to get people to better manage their journeys, the conventional way almost every other nation has used to curb demand has been the application of a taxation system. Dubai's focus is on eliminating excess consumption by investing in educating the consumer, rather than allowing free market economics to drive environmental policy. Although this may sound idealistic, it is also a more long-term method of influencing change from a socio-economic standpoint.

Undoubtedly, the use of tariffs to rationalise consumption could be one of the key initiatives to instigate behavioural changes in the consumer but it needs to be supported by other measures. Diversifying available fuels is urgently required, by incorporating effort and involvement of all stakeholders, such as car manufacturers and suppliers, fuel supply companies, the government, and of course consumers, who will have to make the choice and commit to a more sustainable transportation solution which has less impact on the environment.

The consumer in the UAE pays roughly half of international gasoline prices (accordingly 49% is a subsidy). Many have noted this is less in the UAE than any other GCC states (e.g. 22% in Saudi Arabia). As the UAE addresses the issue of balancing subsidy with motivating consumers to rationalise fuel consumption, it is important to continually improve and invest in new, innovative and environmentally sustainable transport solutions. Low energy prices distort energy allocation preferences while also undercutting upstream investment and efficiency investments.

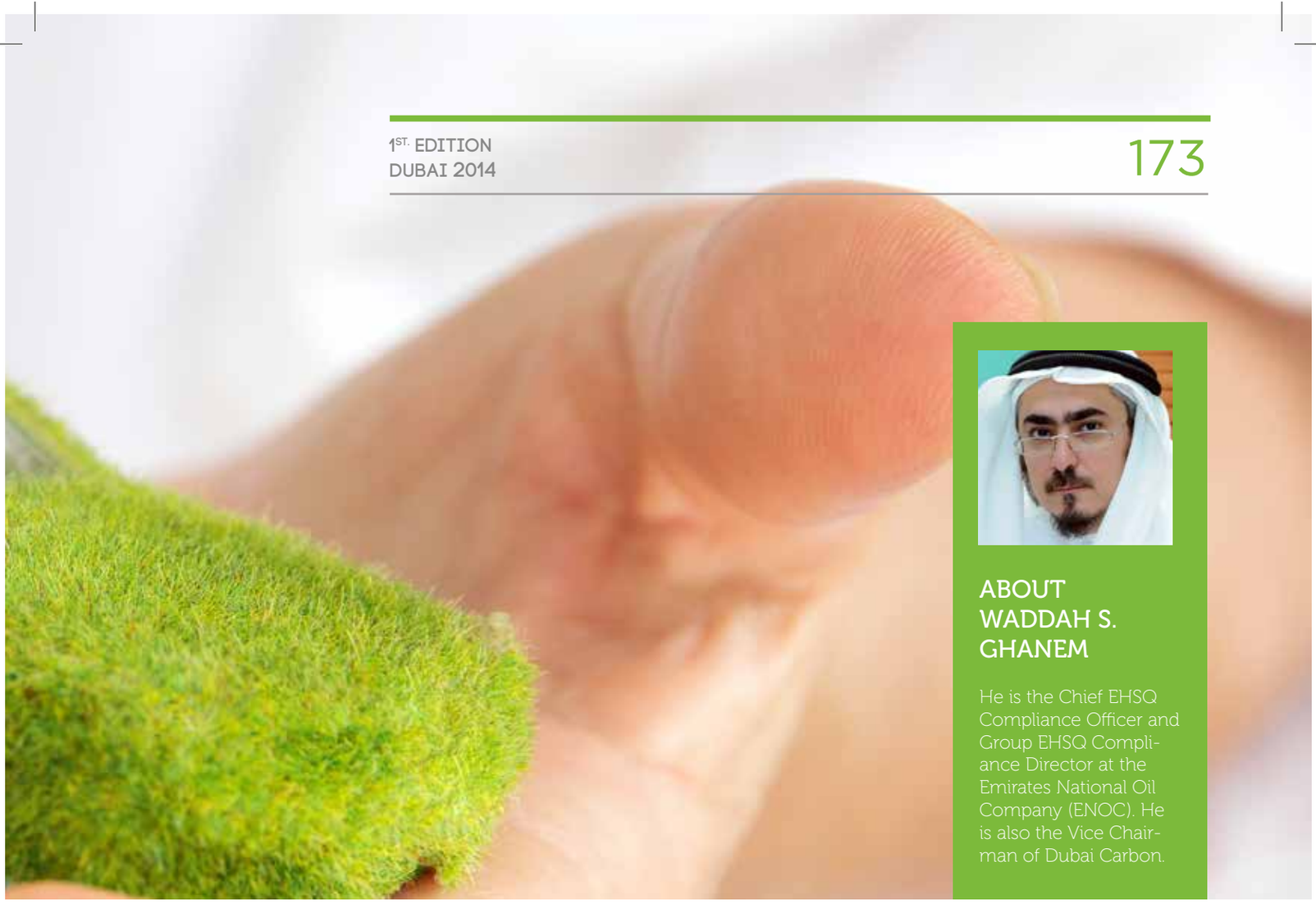
Projects, Innovation and Continual Improvements

There are continual discussions taking place between oil companies that manufacture and supply liquid transportation fuels to the market and ESMA to try to upgrade the quality of fuels entering the market. In the past few years, there have been concerted efforts to drop the sulphur content of fuels, especially gasoil.

However, this comes at an expense, as both the manufacturers/refiners and the major consumers are government entities. In 2008, the UAE cabinet endorsed a standard for gasoil to drop the total sulphur content from 2500 ppm to 500 ppm in gasoil. There are now discussions to switch to an ultra-low content of 10 ppm within the next 18 months.

In terms of projects and innovation within the transport sector, RTA continues to look at how Dubai Metro can expand and develop in the future. To further enhance the convenience of commuters to use this highly efficient and environmentally friendly alternative, the Authority plans to expand its current network, and improve connectivity by using buses to bridge the services.

With the upcoming Mohammed bin Rashid Solar Park, transport systems in Dubai



ABOUT WADDAH S. GHANEM

He is the Chief EHSQ Compliance Officer and Group EHSQ Compliance Director at the Emirates National Oil Company (ENOC). He is also the Vice Chairman of Dubai Carbon.

could potentially be fully run on solar power, and electric cars charged by 100% renewable energy could substitute conventional fuel cars. The RTA is also introducing a tram system in Dubai Marina to provide a fast and reliable way to enter and exit this densely populated residential and tourist area. This will also reduce the number of cars in the vicinity, as well as congestion and pollution. The Marina Tram will have 17 stations along its 14-km stretch, and will run on electrical power. The tram is expected to carry 27,000 passengers per day at the start of operations in 2014, with the number of passengers expected to increase by some 240% by 2020.

In recent years, RTA's Public Transport Agency has been purchasing low emission and energy efficient buses based on Euro 4/5 emission standards. In fact, all the current operating buses are of Euro 4/5 emission specifications. In order to fully benefit from the Euro 4/5, RTA was the first in the Middle East to use engines utilising low sulphur 10 ppm gasoil. They were also the first to introduce Ad-Blue, a chemical injected to the exhaust system to reduce the NOx emissions. In addition, the Authority has also looked at other NOx reduction solutions, whereby exhaust gases are recycled back to the engine for further secondary combustion. Looking at ways to further reduce carbon emissions, the DCCE is also currently working on a major project on sustainable transport with Emirates Transport, which examines ways of improving efficiencies in their fleet, while also looking holistically at the company's operations, including the efficiency of its buildings.

Supporting green transport infrastructure

In 2010, ENOC was the first retailer in the region, and one of the very few in the world, to open a green retail station that features sustainable and environmentally friendly features. These include advanced technological devices to manage the petrol fumes released by the pump.
The station also has significantly reduced energy and resource consumption through solar-powered lighting (which has a much longer life span than conventional systems), solid waste reduction means, and waterless car-washing systems. Efficient water features have been installed to reduce water consumption by a quarter. All non-waterless car wash systems recycle 100% of the water used. The station also has the latest waste management systems that incorporate segregation and recycling, and this includes used lubricant oils.
On the supply side, ENOC has developed the Green Protec© lubricants, improving on the efficiency of engine performance and green lubricants which last longer, are less environmentally damaging, and help reduce emissions by improving overall engine performance. This lubricant is available across all retail outfits, allowing consumers to have easy access to this greener alternative.

Future Developments

The long-term commitment to improve and enhance sustainable transport in Dubai is a major policy objective of the government and the Supreme Council of Energy. Through its member organisations, partners, and other stakeholders, the Supreme Council of Energy is working hard at trying to pave a future set on solid foundations of sustainable transport in the Emirate. This is in line with the UAE Government's vision to achieve continued, sustainable growth for the prosperity and development of the country and its people.
It is clear from the sheer number of major projects; long-term investments in infrastructure development; and the diversity of multi-pronged approaches that look at fuels, modes of transports, infrastructure and the various socio-economic instruments that transportation is and will continue to be a very important focus area in the economic, social and environmental development of Dubai and the UAE.

THE POTENTIAL FOR NATURAL GAS VEHICLES

More than eight decades of research and testing has led to the refining of natural gas as a legitimate alternative for gasoline and diesel-fuelled vehicles, combating the environmental and economic issues associated with traditional modes of transport. An Operating Natural Gas Vehicle (NGV) typically costs 30% less than the same vehicle using gasoline. NGVs produce fewer emissions than traditional gasoline-based vehicles, as natural gas is second only to hydrogen in terms of the amount of carbon dioxide produced when burned. It is also comprised primarily of methane, a molecule naturally found in the environment. With over eight million NGVs in operation in over 50 countries worldwide, there are over 7,000 fuelling stations serving these vehicles.

It was as early as 2006 that ENOC, through its subsidiary Emirates Gas (EMGAS), launched compressed natural gas (CNG) in Dubai and embarked on a pilot project with the Roads & Transport Authority. Diesel-operated wooden 'abras' (traditional UAE boats) were converted to operate on CNG; highlighting its effectiveness as an environment-friendly fuel ideal for all types of transportation modes. The project helped in reducing fuel costs by 30% and expanded the lifetime of engines.

EMGAS has also introduced CNG to fleet users such as Dubai Municipality, DP World, Emirates Group, Transguard and DEWA, amongst others. To initiate green solutions in gas-based applications, EMGAS also developed its first CNG mobile filling station in 2007.

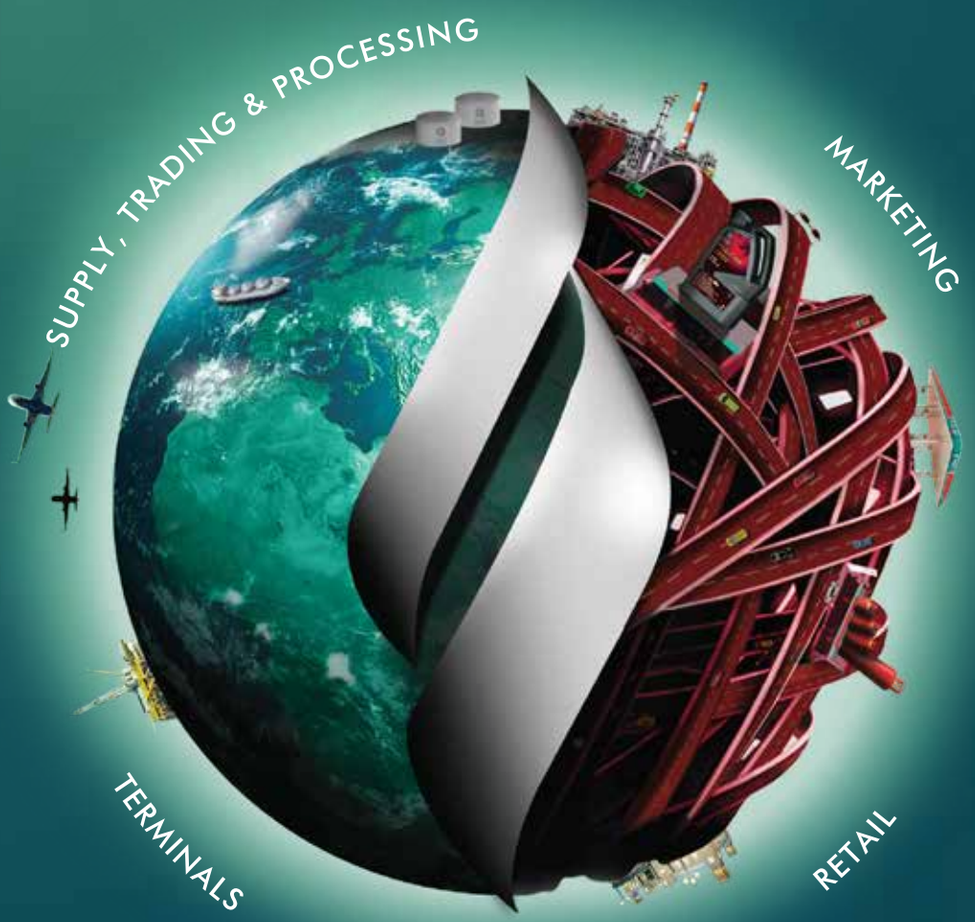
In Abu Dhabi, ADNOC has led the cause for the introduction of NGVs for several years, as they operate much like traditional gasoline-based vehicles, but with significantly lower emissions. Transforming traditional vehicles is unobtrusive, as the engine fuel intake is modified, and a reinforced compressed natural gas storage tank is added to allow a dual fuel system. By doing this, the traveling range of the vehicle between refuelling is doubled, and the driver can shift between fuels by operating a switch inside the vehicle - even while it is in motion.

ADNOC Distribution aims to operate 20 NGV Filling stations in the UAE; 16 in Abu Dhabi and four in Sharjah. In 2011, ADNOC Distribution commissioned its first CNG filling station and vehicle conversion centre in Abu Dhabi, known as 'Khalifa A'. A total of six CNG filling stations have been so far been built.

اينوك
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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EXPLORING ALTERNATIVES

By Saeed Khoury

The complementary nature of vehicles and conventional fuel has posed a significant barrier for environmentally sustainable fuels entering the market. With the advent of alternative fuel vehicles and an increased consumer interest in lower emission transportation, Dubai could spearhead the transition to unconventional fuels within the GCC.

For more than a century, internal combustion engines operating on petroleum fuels have powered almost all light-duty vehicles. Energy security concerns about petroleum imports and the effect of greenhouse gas (GHG) emissions on the global climate are driving interest in alternative fuels, even in resource-rich regions like the Arabian Gulf. While these fuels are in production or under development for use in alternative fuel vehicles (AFV) and advanced technology vehicles, barriers for widespread use still exist within the Emirate and beyond.

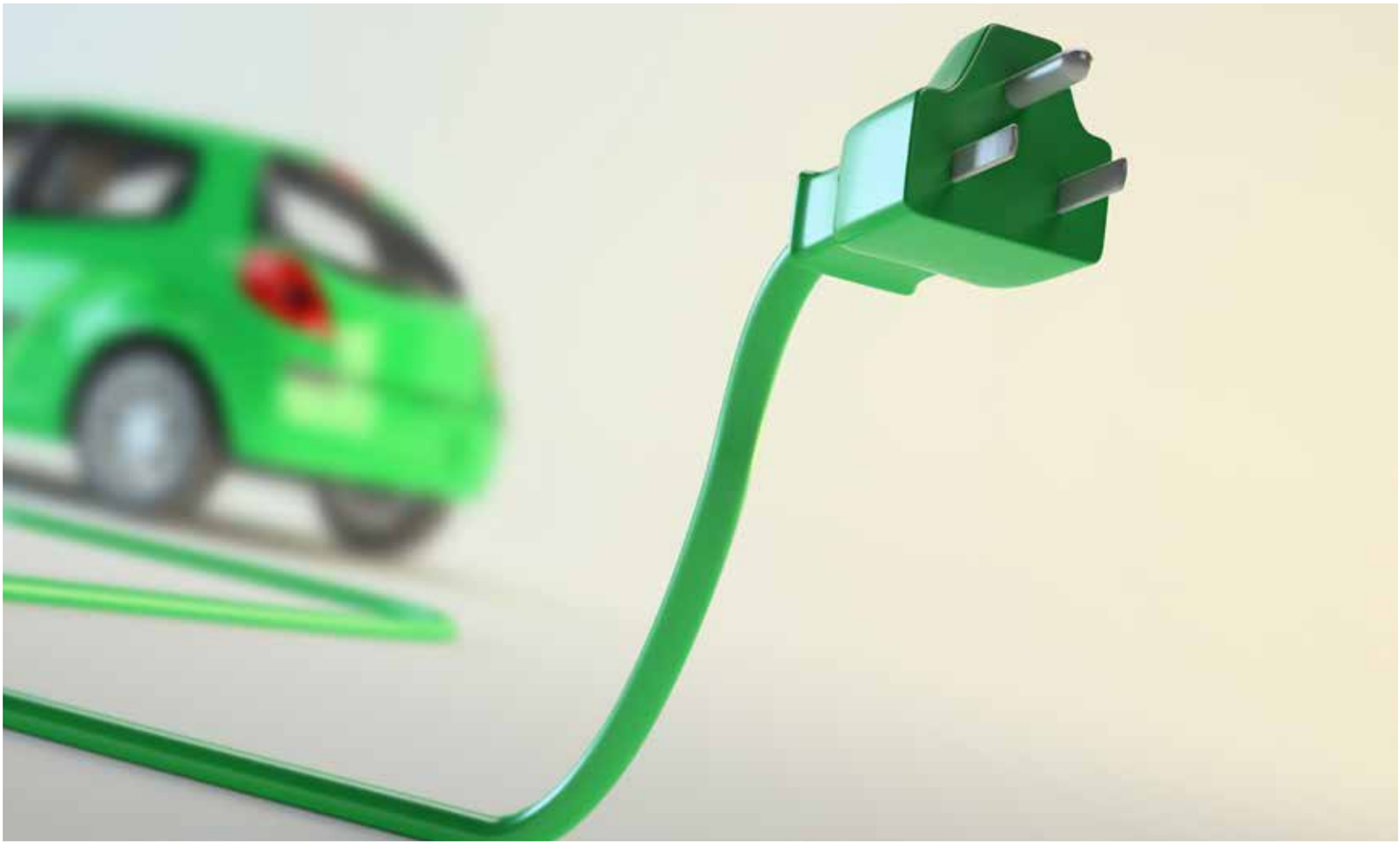
The Curtain Call for Conventional Fuel?

Conventional transport fuels are liquefied fuels derived from petroleum, and are readily available at fuelling stations across the country. This scenario is poised to shift over the next few decades, as we see research into alternatives fuel sources seeping into the current fuel model. The biggest barrier for development is the fact that most vehicles run seamlessly with petroleum-based fuel. Striking a balance between demand-side promotion by increasing consumer awareness, and a significant number of alternative fueling stations through public sector supply-side promotion will be a priority for the Emirate as we enter an age of heightened environmental consciousness.

CNG for emission reduction

Emirates Gas (EMGAS), a business subsidiary of the Emirates National Oil Company (ENOC) has taken on the task of forging this 'road less travelled' by considering a robust Compressed Natural Gas (CNG) refueling infrastructure in Dubai as an alternative fuel source. According Saeed Khoury, CEO of ENOC, "Dubai is committed to promoting alternative energy sources internally, which is underlined by the support extended to our CNG initiative by various government entities. (EMGAS is) looking at providing a robust CNG refuelling infrastructure to make it available as an alternative and more sustainable fuel for the transport sector." Outlining the benefits of CNG, he adds, "This will have a positive impact on the air quality within the city as vehicles using CNG will have considerably less tail pipe emissions."

EMGAS has also embarked on an ambitious programme to convert gas currently being flared by Dubai Municipality from its sewage treatment plants landfill sites into Bio Methane Compressed Bio Gas (CBG). Instead they are seeking for it to be utilised as an alternative automotive fuel along with CNG. This waste-to-energy pilot project is the first of its kind in the region, highlighting the practical application of alternative fuel for large-scale use. "We see strong prospects for the practical large-scale applica-



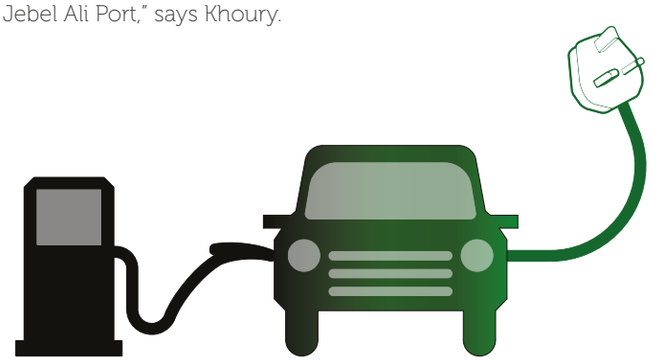
tion of alternative fuel. In fact, through our CNG/CBG initiative, we expect to refuel 15,000 vehicles per day using cleaner and greener fuel," says Khoury, looking at the future of CNG in the Emirate. In order to ensure that the highest fuel efficiency and emissions standards are upheld, the Emirates Authority for Standardisation and Metrology (ESMA) has put a formal framework in place relating to specific CNG retrofit systems. In order to facilitate market penetration and expansion, CNG fuelling stations will need to be widely available throughout the Emirate.

LNG: An accessible option

Globally, natural gas has gained widespread acceptance as a transportation fuel with nearly 15 million natural gas-fuelled vehicles. It is anticipated that about 20 million will be natural gas powered by year 2016.

Compared to diesel, LNG reduces NOx emissions by 80%, particulate emissions by 75%, and cuts overall greenhouse gas emissions in a range between 11% and 20%. In addition, when used as a vehicle fuel, LNG engines run more quietly than diesel engines.

"Currently, due to the non-availability of indigenous Natural Gas in Dubai, the utilisation of imported Liquefied Natural Gas (LNG) is considered as an alternative fuel for the transport sector with provision for receiving imported LNG available at Jebel Ali Port," says Khoury.



7. FUEL AND MOBILITY

The EV trend

Electric and hybrid cars have yet to enjoy substantial market penetration in Dubai, despite rumours circling the automotive industry regarding new entrants into the market. In the golden expanse on America's Arizona's desert, electric vehicles (EV) like the Nissan Leaf have been noted for their waning capacity. The intensity of the desert heat poses a heavy strain on portable batteries, causing the storage capacity to deplete by over 30%, according to American reports.

The problem is likely linked to the vehicle's air-cooling system for the battery. The fact remains that all EVs experience battery issues in high temperatures, which is why major manufacturers like Ford (with their Focus EV) and Toyota (with their hybrid Prius) are set against this market. While all cars entering the GCC are hot-weather tested, EVs will require additional cooling modifications before they can be launched for the general public. So far, BMW (on request), Porsche, Lexus and Fisker Karma offer hybrid cars in the UAE.

Even with modest market penetration, the UAE lacks infrastructure to support EVs. Without fuelling stations that are equipped to charge these vehicles, owners will have to err on the side of caution and stick to less than 100-kilometre distances when on the road. Considering the expanse of the UAE's road network, this is a factor that could pose yet another barrier for consumers.

On the demand side, EVs are still not economically attractive for the greater proportion of the region's demographic. With eight-lane highways and an advanced road network, the lure of the open road also translates to consumers favouring massive SUVs or sleek sports cars—where gas mileage and fuel efficiency become inconsequential, if not an afterthought.

Proponents of EVs often note that in Dubai, these vehicles rely on electricity served by the city's grid—which is generated from a diverse mix of sources, including petroleum. Choosing to own an electric car here would cancel out the benefits of it being an environmentally conscious consumer choice; until such time that solar-powered fuelling stations are in place for the niche EV market.

The road ahead

As far as feasible fuel options are concerned, companies like ENOC and ADNOC are championing cleaner sources like CNG, mainly by supporting a smooth transition in the UAE's private transportation industry from petroleum-reliant sources to alternatives that are both environmentally and economically sustainable.

ABOUT SAEED KHOURY

Born in 1956, Saeed Abdullah Khoory has nearly three decades of experience in exploration and production, both onshore and offshore. A graduate in Petroleum Engineering from the University of Tulsa, USA, he has established his mark by utilising cutting edge technology to enhance the full field development plans for most oil fields to increase oil production. Khoory is the Chief Executive Officer at ENOC, Chairman of the Board of various joint ventures and subsidiaries within ENOC. He is an active member of The Supreme Council of Energy.

FIRST GREEN SERVICE STATION

ENOC's first green service station is in The Greens neighbourhood in Dubai and introduces a range of unique features, all aimed at reducing the carbon footprint of customers.

Among the green initiatives at the station are advanced technological devices to contain petrol fumes released by the pump and a variety of other state-of-the-art systems; these include including solar-powered lighting, a 'waterless' car-washing system, new waste segregation systems and design upgrades to reduce noise pollution.

The station generates half of its energy requirements from renewable sources, and it uses Solar Powered Pole and LED lights, with a long life span of up to 50,000 hours and low voltage which also reduce the risk of electrical fires. These lamps do not need to be replaced for up to 12 years. The service station also makes use of sensor type water taps and two-stage flush systems in the toilets. Sustainable water features have been installed to reduce water consumption by a quarter. The new service station recycles carwash water and provides customers the option to use a waterless car wash system, which cleans cars without using a single drop of water.

The waterless car wash concept saves water and prevents detergents from polluting the environment with its new 'No-Wet' technique, an all-in-one eco-friendly car wash liquid. Made from natural ingredients, the product does not contain petroleum distillates, silicone, abrasives, harmful chemicals or detergents that pollute water.

ENOC will also equip the new green service station with the latest waste management systems, including a garbage segregation system that provides colour coded bins for easier recycling. Moreover, the furniture used will be made from recycled materials, while used lubricants oil will be collected and disposed of. The station also features a centralised vacuum system to support power conservation and reduce waste and noise.

SUSTAINABILITY IN PUBLIC TRANSPORT

HE MATTAR AL TAYER FOR STATE OF ENERGY REPORT

The Roads and Transport Authority (RTA) in Dubai highly values this opportunity to share our strategy and achievements on Energy Management and Sustainability with the Dubai Supreme Council of Energy.

RTA, in alignment with the Dubai Government's Strategic Plan, is responsible for developing and delivering integrated and sustainable transportation systems. RTA provides world class services to all stakeholders to support Dubai's comprehensive growth plans through preparing policies and legislations, adapting technologies and innovative approaches, and implementing world's best practice standards.

Furthermore, RTA, through its stated Vision and Mission and in accordance with Dubai Integrated Energy Strategy 2030, is committed to reducing the negative environmental effects associated with fuel utilization by using energy efficiency practices through innovative technologies and green procurement.

RTA has launched Mobility Management Initiatives, which have introduced a number of different Travel Demand Management (TDM) measures, to reduce the fuel consumption and CO2 emissions for private cars.

RTA ensures continual improvement to energy performance by confirming compliance with ISO 14001:2004 and ISO 50001:2011 standards requirements.

In total RTA strives to reduce car dependency, enhance personal mobility and develop the liveability and sustainability of Dubai as a global city through this integrated approach.

The Roads and Transport Authority (RTA) is following a focused development plan to increase the mode share of buses in conjunction with other higher capacity means of transportation, such as the Light Rail and Metro; this is part of its larger plan to establish a comprehensive public transportation system in Dubai. The RTA's approach for the procurement of the new buses is one of the most important tasks for the realisation of this plan, as the future bus fleet of Dubai will include standard buses, articulated buses and double-deck buses.

Special emphasis was given to the exterior and interior design of the vehicles to promote the corporate identity of the RTA fleet.

Figure 3: Exterior design of double-deck bus

The technical specifications per selected vehicle type were developed with sufficient details for the bus manufacturer to provide the optimal solution to suit the unique hot and humid desert environment. Fuel option and engine specifications have a direct impact on vehicle efficiency and emissions, leading the RTA to delve further into research and development for the optimum solution.

Fuel Option

Diesel fuel was found to be the most suitable and optimal fuel type in the current scenario for Dubai buses. The fleet adheres to low emission standards compared to Euro III vehicles, and offers a realistic solution for short-term period. The technology is internationally well proven, and does not require high initial investments or maintenance and infrastructure costs. The current state-of-the-art diesel buses already comply with Euro 4/5 standards, and are equipped with intelligent engine management and exhaust gas after-treatments (SCR and EGR). This further reduces the NOx due to higher burn temperature.

Based on these considerations, the RTA's Public Transport Agency purchased low emission and energy efficient buses based on Euro 4/5 emission standards. Previous fleets purchased were based on the Euro 3 standard, but now all operating buses are of Euro 4/5 emission specifications. To realise the full benefits of adhering to these standards, low sulphur diesel fuel (10ppm gasoil) was imported into Dubai; a regional 'first' in the Middle East. The RTA was also the first to introduce Ad-Blue, a chemical injected to the exhaust system to reduce the NOx emissions. In addition, the RTA also considered a measure by which exhaust gases are recycled back to the engine for further secondary combustion.

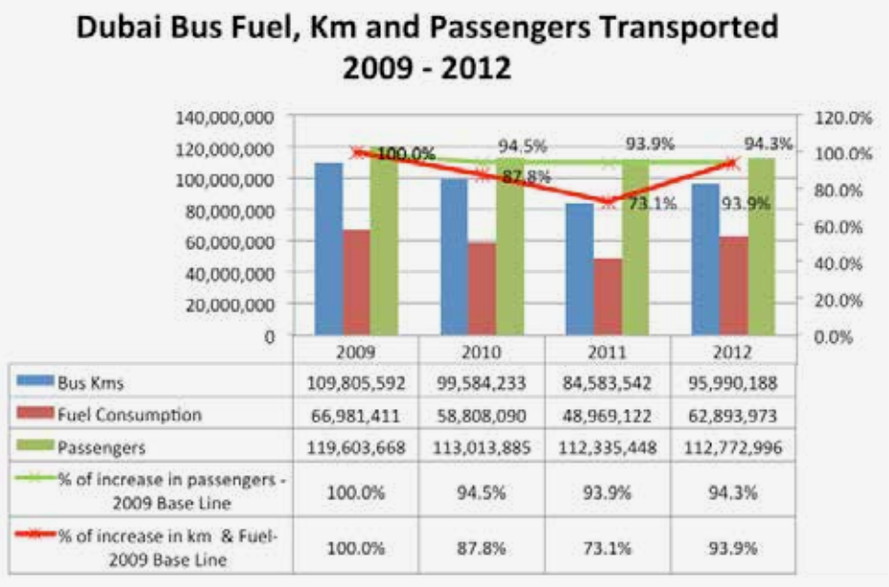
Table 1: Comparison of Emission standards for lorries and buses in g/kWh (smoke in m–1)

Tier	CO	HC	NOx	PM	Smoke
Euro 3	2.1	0.66	5	0.1	0.8
Euro 4	1.5	0.46	3.5	0.02	0.5
Euro 5	1.5	0.46	2	0.02	0.5

Engine Power Efficiency

Euro 4/5 employs a more fuel-efficient technology compared to the Euro 3 standard, outweighing its energy output by 3%, as the energy consumption of the Euro 3 is 212g/kWh compared to 196g/kWh of the Euro 4/5, in a typical urban driving condition.

Fuel consumption was gradually reduced between 2009 and 2011 as a combined effect of network rationalisation and better fuel efficiency. The fuel consumption increased in 2012 due, in part, to an increase in operations in terms of kilometres, as shown in Figure 4.



	2009	2010	2011	2012
Bus Kms	109,805,592	99,584,233	84,583,542	95,990,188
Fuel Consumption	66,981,411	58,808,090	48,969,122	62,893,973
Passengers	119,603,668	113,013,885	112,335,448	112,772,996
% of increase in passengers - 2009 Base Line	100.0%	94.5%	93.9%	94.3%
% of increase in km & Fuel- 2009 Base Line	100.0%	87.8%	73.1%	93.9%

Figure 4: PTA Fuel, Km and Passengers Transported 2009 – 2012

7. FUEL AND MOBILITY

Conclusion

With the implementation of the 'Bus Master Plan' for the short to medium term, RTA's Public Transport Agency continues to monitor the new developments of buses and bus propulsion technologies, such as diesel hybrid, CNG, biodiesel and electric buses. While these developments have provided results based on the European operating environment, RTA continues to monitor the performance, given Dubai's climatic requirements. In addition, RTA is also monitoring the development of fuel alternatives such as gas to liquid and biodiesel options, which will be taken into account during future procurement cycles.

THE GREEN BUS

Aligning their goals with the Green Economy initiative launched by His Highness Sheikh Mohammed bin Rashid Al Maktoum, UAE Vice President and Prime Minister and Ruler of Dubai, the Road and Transport Authority (RTA) developed the 'Green Bus' as a regional 'first'. In order to provide safe, sustainable public transportation, the RTA Green Bus employs the latest technologies, from using solar energy to power its interior lighting, to running on a low emission biofuel blend. This pilot project is endorsed by the United Nations Environmental Programme (UNEP), and is implemented in partnership with S. S. Lootah. The Green Bus is currently operational and has donhas been showcased at various energy and environmental forums as a means to demonstrate the RTA's efforts in supporting and enhancing green technologies.

The Green Bus Operates on Biofuel (B05), which is produced from recycled waste cooking oil (5%) in combination with Ultra low sulfur diesel. This simple ratio would reduce emissions by 78%.

The bus uses retreated tyres and organic, eco-friendly material for its flooring.

The bus uses solar energy to power its interior LED lighting.

DUBAI'S NEW TRAM ON LINE FOR 2014

After the opening of its driverless metro in 2009, Dubai is yet again about to complete another 'first' for public transport in the UAE. The Emirates' tram service, which will improve connectivity in one of the busiest areas of the city, is set to start in November 2014.
Developed by Dubai's Roads and Transport Authority, the project is also the world's first tramway powered by a ground-based electric supply system that extends along the entire track.

In its first stage, the Al Sufouh Tram will run along 10.6 kilometres of tramway with 11 stations located along the route. This will cover the popular areas of Dubai Marina, Jumeirah Beach Residence and office developments along Al Sufouh Road. When completed, the system will stretch to 14.6 kilometres and will have 17 stations. The trams' manufacturer, French conglomerate, Alstom, is already testing the trams on a 700-metre-long track in France. The first tram is set to arrive in Dubai in December 2013, and testing on the new track will start in January 2014.

With three coaches, each with a capacity to accommodate 300 people at a time, every tram will have a separate cabin for women and children, as well as Gold Suite and Silver Class cabins.

All stations will have central air-conditioning systems, automated fare collection machines and sophisticated surveillance systems.
At the start of operations in 2014, the tram is expected to carry 27,000 passengers per day, with ridership expected to increase to 66,000 people per day by 2020.

RENEWABLE ENERGY FROM WASTE

ENOC, EMGAS and Dubai Municipality are piloting the use of land and sewage waste to generate CNG. EMGAS is setting up an advanced facility to convert waste to biomethane (from what is currently being flared), and then compacting it into compressed natural gas - to be used as an automotive green fuel.

The biogas, and subsequently CNG, will be generated at the upcoming EMGAS facilities at Dubai Municipality's sewage and landfill sites in Al Aweer and Al Qusais.

This will be done in compliance with international CNG standards using the latest technologies from America and Europe.

The CNG will be marketed for use as automotive fuel, which will help reduce carbon emissions and promote sustainable development. Upon the completion of the project, EMGAS will provide CNG to approximately 15,000 passenger cars and light commercial vehicles per day.

ADDITIVES TO FUEL

The formulation of additive systems for motor oils continues to grow more complex as engines and emission systems evolve to meet more stringent requirements for European and North American markets. Lubricants are not only expected to protect the engine, but are formulated to minimise any impact they may have on the exhaust after treatment devices such as catalytic converters and diesel particulate filters. While there is a general trend towards low sulfated ash, phosphorus and sulfur (SAPS) formulations in engine oil packages throughout the world (in the interest of lowering environmental impact), even additive technologies have additional limitations in the amounts of SAPS in the system to minimise the potential of after-treatment device tainting. The crucial factor in formulating additives is in attaining engine durability while enabling better fuel economy, engine efficiency and emission system compatibility.

In 2011, ENOC Lubricants introduced a new high performance product based on low SAPS additive technology in the UAE. The product, Protec X-treme Energy 5W 30, has delivered higher fuel efficiency and better engine performance over mineral oils for new generation vehicles, plus superior environment-friendly characteristics, based on numerous comparison studies. The low SAPS oil is fully synthetic and can be used in engines running on petrol, diesel, CNG and LPG. Saeed Abdullah Khoory, ENOC Group Chief Executive emphasised how this product "is meant to address energy and environmental concerns, ensure better health for vehicle engines, and contribute to lessening global warming and other environmental issues." As low SAPS are very sophisticated lubricants that are costly to develop, palpable market penetration may take time. ENOC Lubricants is the first company to launch environment-friendly and energy efficient products in the UAE, complementing the UAE government's initiatives to introduce emission caps for green house gases.

LEADING THE WORLD IN AVIATION FUEL EFFICIENCY

By Paul Zissermann

Carrying 2.8 billion passengers and generating $2.2 trillion of economic benefits, the aviation industry's global social and economic contributions are enormous. In Dubai alone, aviation contributes $22 billion (or 28%) to the Emirate's GDP, while generating over 250,000 jobs, according to 2012 figures released by Dubai Airports.

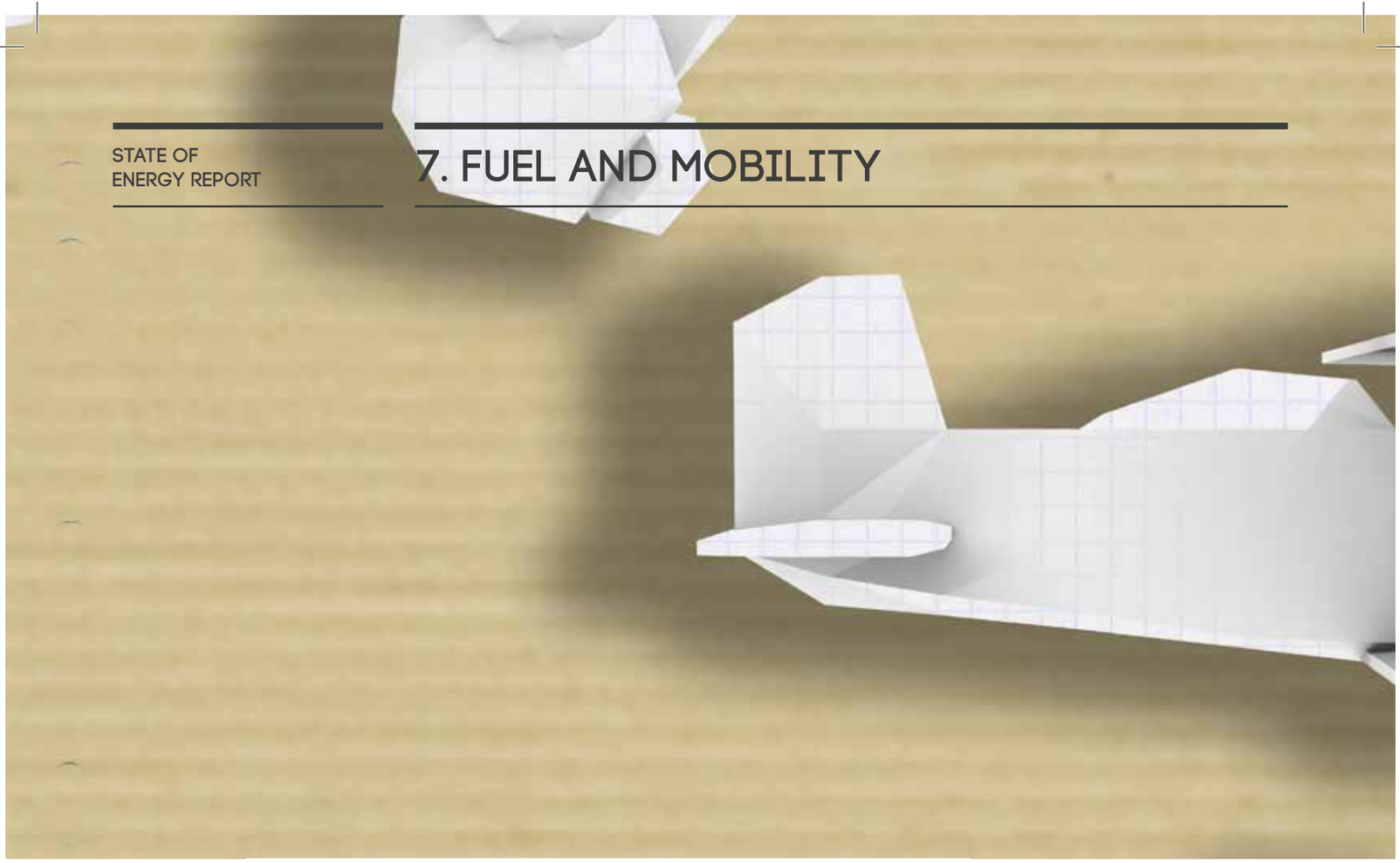
Although the Intergovernmental Panel on Climate Change estimates that international aviation currently accounts for only 2% of manmade global greenhouse gas (GHG) emissions, this is still a significant contribution of approximately 628 million tonnes CO_2 per year. These emissions are growing at about 4% per annum and are mostly emitted at high-altitude, where their radiative forcing index (RFI), or atmospheric warming potential, is considered to be several times higher than when emitted at ground level.

Recognising this fact, the aviation industry has made a number of high-level commitments to continue to improve its fuel efficiency and to reduce its overall carbon footprint. In 2009, the Aviation Transport Action Group (ATAG), which represents airlines, air navigation service providers, aircraft manufacturers and airports, released ambitious targets to reduce the industry's GHG emissions. These include a 1.5% per annum fuel efficiency improvement for the global aircraft fleet, carbon-neutral growth from 2020 onwards, and a 50% reduction in absolute CO_2 emissions by 2050.

Striving towards maximising fuel efficiency is an inherent concept within the aviation industry, as manufacturers and airlines push to develop aircraft that can fly further, while carrying more passengers and cargo, and using less fuel. ATAG estimate that a modern commercial passenger aircraft is now some 82% more fuel efficient (per passenger kilometre), than aircraft manufactured in the 1960s.

This focus on fuel efficiency has gathered increasing momentum in recent times, with the dramatic rise in oil and jet fuel prices, and a closer focus on aviation emissions. Recent reports by the International Air Transport Association (IATA) show that fuel costs now represent an average 33% of an airline's operating costs, more than double the figure of 13% in 2001. Dubai's Emirates Airlines' annual fuel bill for the last financial year was an incredible $7.6 billion, almost 40% of its operating costs. It is therefore easy to see how improvements in fuel consumption are intrinsically linked to reducing airlines' operating costs and reducing greenhouse gas emissions from aviation.

7. FUEL AND MOBILITY



Emissions reduction strategy

The aviation industry has proposed to tackle its greenhouse gas emissions under a four-pillar strategy, focusing on:

1 Improved technology

Some 5,500 aircraft will be replaced globally by 2020, resulting in a 21% reduction in CO_2 emissions. The introduction of new generation biofuels has the potential to reduce aviation emissions by up to 80% on a full carbon life-cycle basis.

2 More efficient operations

Improving operational procedures has the potential to reduce aviation emissions by a further 3% by 2020.

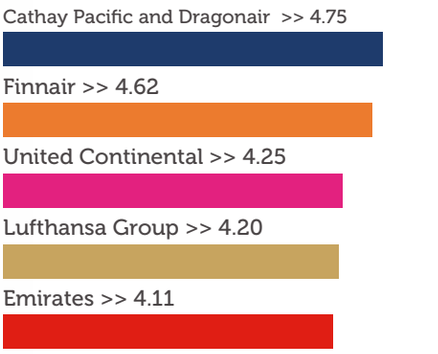
3 Efficient infrastructure

Improving air traffic management (ATM) practices could provide an additional 4% emissions reduction for the aviation industry by 2020.

4 Positive economic measures

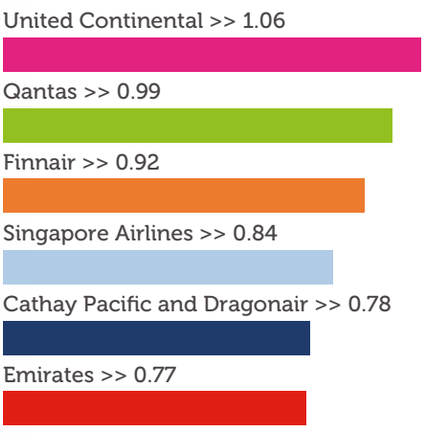
In addition to the three pillars above, IATA forecast that due to the industry's continuous growth, some 90 million tonnes of CO_2 will still need to be offset by 2025, in order to maintain emissions at 2020 levels and to achieve the industry's target of carbon neutral growth from 2020.

Passenger fuel efficiency in 2011-2012
(L/100PK)

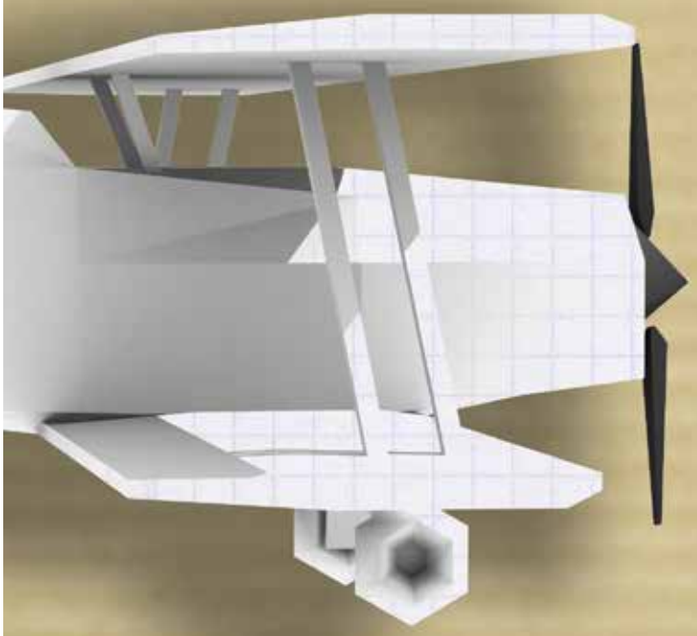


IATA forecast global fleet average >>5.3

Overall CO2 Efficiency in 2011-12
(kgCO2/TK)



IATA global fleet average >> 0.94



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Local perspective

The UAE's aviation industry is one of the fastest growing and most modern in the world. Established in Dubai in 1985 with only 2 leased aircraft, Emirates is now the largest international airline in the world (by revenue passenger kilometres). It currently has a fleet of over 200 modern aircraft, with over 30 Airbus A380s and more than 80 Boeing 777s – with another 60 and 30 on order, respectively. Emirates' average fleet age is 6.4 years, almost half of the industry average age for wide-bodied aircraft of 11.3 years. These new, highly efficient aircraft, operated at passenger seat factors averaging 80%, give Emirates one of the best fuel efficiencies in the world, especially for an international scheduled carrier offering premium services.

In 2011-12, Emirates' passenger fuel efficiency was reported as 4.11 litres/100 passenger kilometres (L/100PK), some 22% lower than the IATA forecast global fleet average of 5.3 L/100PK.
Based in Abu Dhabi, Etihad's fleet consists of 78 modern, efficient aircraft, such as Boeing 777s and Airbus A320s, A330s and A340s, with a fleet age of just under 5 years. This also gives Etihad a fuel and CO_2 efficiency advantage over other airlines, at around 0.77 kg CO_2/TK (tonne kilometre), well below the IATA global fleet average.

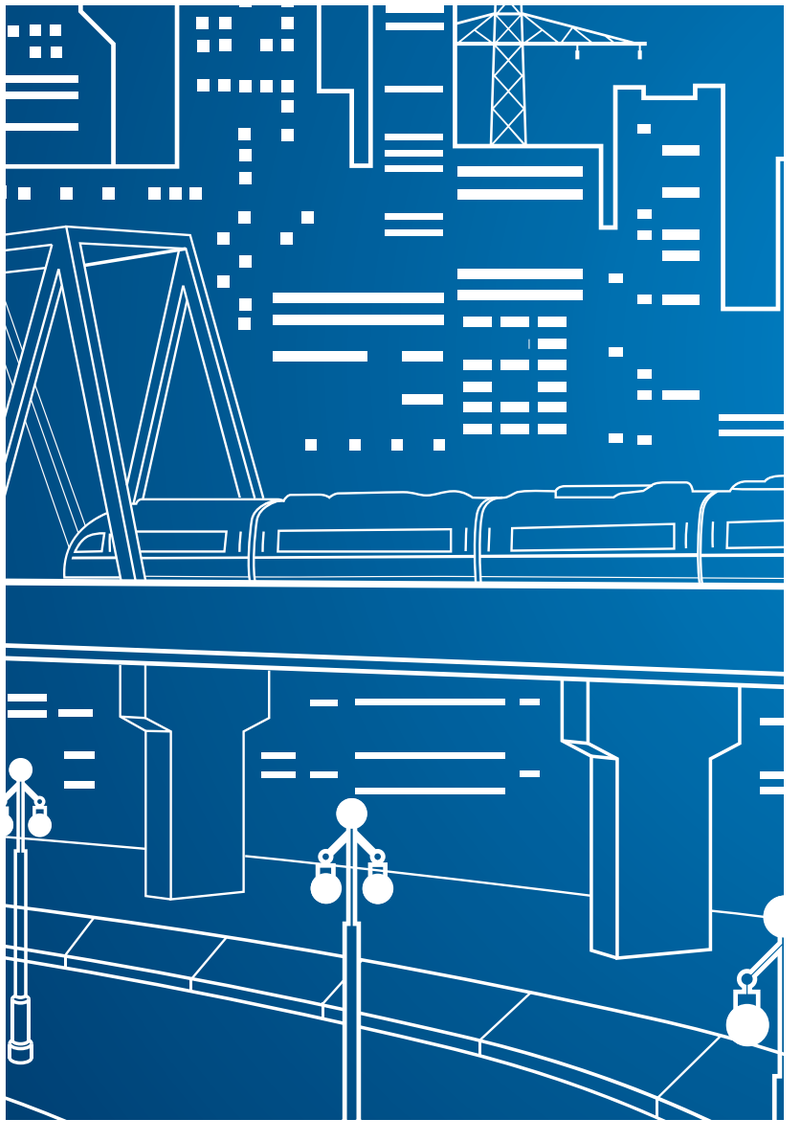
Likewise, flydubai, Emirates' low-cost cousin, has invested heavily in the latest Boeing 737-800 aircraft, with 30 in its fleet at the time of writing, and an average age of only 2.1 years. Although not publicly reported, flydubai's fuel efficiency is likely to be even lower than Emirates' and Etihad's, due to the type and age of aircraft in its fleet, and the high passenger load factors typically experienced by low cost carriers.

What has become apparent in recent years is the significant role that the UAE airlines are playing in this area. Given the multi-billion dollar investments made by Emirates, Etihad and flydubai in the most modern, fuel-efficient and low emissions commercial aircraft available today, it is not surprising that UAE airlines are at the leading edge of the fuel efficiency curve.

ABOUT PAUL ZISSERMANN

Paul is an independent sustainability advisor based in Dubai. With over 20 years experience in the global environmental and sustainability field, he has worked with governments, large corporations, NGOs and international consultants in a wide range of industry sectors – from aviation to infrastructure to natural resources. Paul was previously Manager of Environmental Affairs with Emirates Airline. Contact Paul and 'Green Stategies' via http://www.linkedin.com/pub/paul-zissermann/a/3ba/2a5

ENERGY EFFICIENCY IN RAIL OPERATIONS



The improvement of public transport infrastructure to ensure its reliability and sustainability was a top priority for the Dubai Government. Since its establishment, the Roads and Transport Authority's (RTA) vision for 'Safe and Smooth Transport for All' has led to the development of an integrated multi-model public transit system, which includes rail, marine, and bus systems. In alignment with the Dubai's strategic plan for a sustainable future, four out of the eight strategic goals outlined by the RTA are directly related to sustainability, with an emphasis on environmental and energy issues.

Spanning 76 kilometres, the Dubai Metro was developed as part of a comprehensive rail transit network, and is expected to accommodate the future needs of the growing city. It was planned as part of the 'Strategic Integrated Master Plan', aimed at increasing the public transport mode share from 6% to 30% by 2030. It is the world's longest fully automated driverless metro network system. Recognised for its substantial contribution to environmental protection and energy conservation, Dubai Metro has also contributed to an improvement in the health of the public as a non-polluting mode of transport. There are two lines: the Red Line was launched in 2009 (with 28 out of 29 stations currently operational), and the Green Line was launched in 2011 (with 18 out of 20 stations open to the public). Today, the metro carries around 360,000 passengers daily. With the metro in place, the Emirate has seen a rapid increase in mobility, with over 178 million passengers last year alone. In terms of its environmental impact, in 2012 it led to a reduction in Dubai's carbon footprint by 394 tonnes daily. Providing affordable public transport as an alternative to private vehicles, the metro has been instrumental in improving traffic conditions in key areas by 25%, while leading to the appreciation of the property value of buildings neighbouring the metro track by 20%. Using 2011 as a baseline, studies indicate that in 2012 the electrical consumption per passenger decreased by 19%. The total electrical connected load of the Dubai Metro is 129,790 KVA, leading the RTA to consider an Energy Management Plan (EMP) to minimise energy consumption. The EMP led to Dubai Metro opting for energy efficient equipment and monitoring apparatus that allowed observation of energy usage on a continuous basis. Beyond minimising power usage, the EMP has led to a reduction in maximum power demand, and maintaining the power factor at 0.9.

Additionally, as a result of using the water cooled air conditioning system supplied by a district cooling plant, the total connected electrical load for the air conditioning was reduced by more than 14 megawatts. Moreover, the electrical consumption fell by 28,541,062 kilowatt-hours per year.

THE ENERGY MANAGEMENT PLAN IN REVIEW

1. Design for Energy Efficiency

In developing an energy efficient design, the major energy-use centres have been identified and efforts are being made to ensure conservation strategies are consistently applied.

2. Energy Surveillance

The SCADA is being used for monitoring energy consumption on a real time basis.

3. Power Consumption and Maximum Power Demands

Load Analysis and Voltage Drop Calculation provides the basis for the Power Distribution System (PDS).

RTA, 2013

GREEN ROUTES FOR TRANSPORT SUSTAINABILITY

By Samuel Merkli

Transport networks are essential to sustaining the economic growth seen in recent years, but they also face financial and environmental challenges. Technological innovations in transportation can help to reduce energy consumption, curb CO_2 emissions and reduce air pollution by road, rail and sea.

Metro and Rail solutions

Flagship rail networks, including the Dubai Metro and Saudi Arabia's Haramain high-speed railroad (HHR), are good examples of how technology is helping to deliver sustainable transport solutions.

ABB's Substation Control and Monitoring Systems (SCMS) and low-voltage products are delivering reliable power to stations on the Dubai Metro. The SCMS has been installed by the Dubai Electricity and Water Authority (DEWA) at three substations to supply power to all stations on the metro's Red and Green lines. The technology is designed to increase energy efficiency and grid reliability by monitoring and managing power quality.

ABB also supplied low-voltage equipment for power distribution on the Dubai Metro. The equipment feeds power distribution, lighting and heating, ventilation and air-conditioning (HVAC) systems.

Like many railways, the Haramain high-speed railroad in Saudi Arabia (HHR) has many thousands of induction motor air conditioners which can cause voltage dips and depressions that affect railway services. The Saudi Electricity Company (SEC) has overcome these by installing ABB's static Var compensators at each end of the 445-kilometre railway to compensate for the power fluctuations caused by the air conditioning equipment. According to Brice Koch, head of ABB's Power Systems division: "This solution will help strengthen the transmission grid and enhance reliability of power supply to important rail links in Saudi Arabia."

Fast charging networks for Electric Vehicles

Electric vehicles (EVs) are another area of rapid development that is of growing interest to drivers in Dubai. EVs are hitting the mainstream and likely to drive growth in demand for fast charging points. The low running costs and low emissions of EVs make them increasingly attractive to drivers.

The world's first example of a nationwide network of fast chargers for EVs was installed by ABB in Estonia in 2011, and the firm is now setting up the world's largest fast charging network in the Netherlands. ABB's fast charging technology can charge a vehicle in under 30 minutes, compared with up to eight hours for a conventional residential power outlet. It complies with multiple charging standards for EVs, including CHAdeMO and CCS.

One objective in both countries was to promote the uptake of electric vehicles by providing the fast charging network to support them.

By installing a nationwide network of chargers no further apart than 50 km in the Netherlands and 60 km in Estonia, EVs will be able to travel anywhere within the states without running out of power, with drivers paying for top-ups through local parties.

ABOUT SAMUEL MERKLI

Samuel Merkli is the ABB business development manager for energy efficiency in the India, Middle East and Africa Region, based in the UAE. Samuel joined ABB in 2009 and holds a double Master's degree in Business and International Management from the University of St.Gallen and the CEMS alliance of top-ranked European business schools.

Electric flash-charging buses

New flash-charging electric technology is another innovation that can lend itself to road transport in Dubai. The technology is already proving itself in a pilot service in the city of Geneva, Switzerland. A large-capacity electric bus serving a route between the city's airport and international exhibition centre is being powered by a new ultra-fast charging system.

Carrying up to 135 passengers, the bus delivers silent and sustainable urban transport. It receives a 15-second energy boost at selected bus stops through an automatic flash-charging mechanism. The mechanism uses a laser-controlled moving arm, which connects to an overhead charging point at bus stops, instead of using traditional overhead lines that span across the entire city.

The buses are fully charged during a three- to four-minute boost at the end of the line, while on-board energy storage and breaking energy recovery systems ensure maximum overall energy efficiency.

Shore-to-ship power

Another area of surface transport where ABB's recent innovations are helping cut emissions of CO_2, NOx, SO_2 and particulates is shore-to-ship power. By supplying electricity from the shore, ships can turn off the diesel engines that are otherwise needed to power heating, lighting and refrigeration.

Having pioneered this technology in Gothenburg, Sweden in 2000, ABB has since supplied shore-to-ship connections in ports worldwide, including Rotterdam and most recently the world's first and only 'green shipyard' in Pipavav, India.

ABB's turnkey solutions ensure that ships can access power at the right voltage and frequency to power on-board systems. Such connections can represent significant savings in emissions – in a 10-hour port stay, a single cruise ship can burn 20 metric tonnes of fuel, producing 60 metric tonnes of CO_2, equivalent to the annual output of 25 average-sized cars.

Recent years have seen ABB make significant advances in sustainable transport, pushing down emissions to deliver cleaner and more efficient rail, road and ship power solutions. As Dubai continues its evolution as a major world city, sustainable transport solutions like those developed by ABB may have a part to play in the city's infrastructure.

DUBAI'S MARITIME SUSTAINABILITY PROGRAM

By Amer Ali

The Dubai Maritime City Authority (DMCA) streamlines all maritime related activities in the Emirate to create a safe and vibrant maritime environment in Dubai

The DMSP reflects Dubai's aspirations for a sustainable future for all of the UAE. To ensure a sustainable future today DMCA, in conjunction with DSCE, DPWorld, and Dubai Municipality, has embarked on a journey to pioneer and implement a series of innovative maritime initiatives. The MSP Initiatives are designed to address both the environmental and safety challenges facing the maritime domain within Dubai and the UAE.

The Ocean going Vessel's Sulfur Reduction Initiative

The Ocean Going Vessel's Sulfur Oxides (SOx) Emission Reduction was launched in 2011, with the focus being on the largest fleet consuming the greatest amount of fuel – 15,000 OGV – during annual visits to Dubai waters. The initiative helps reduce the overall loading of SOx emissions by OGVs through monitoring of fuel consumed in the waters.

Working with public sector partners and bunker suppliers, and bunker testing labs DMCA found out thatthe region had the highest levels of sulfur in marine fuels approximately 4.3% versus a global average percentage of close to 3%.

DMCA set a standard of 3.35% for bunker fuels in Dubai. Through the monitoring of bunker delivery notes and receipts and the independent reports from the testing labs DMCA has now established that the sulfur percentage in marine fuel in Dubai is now 3.21% - a drop of over 25%. Conservatively that is a reduction of 50,000 tons of SOx annually.

ABOUT AMER ALI

Amer is the Executive Director of the Dubai Maritime City Authority, the government entity in charge of regulating and safe-guarding the maritime sector in Dubai.

The Traffic Separation Scheme Initiative (TSS)

This was launched in 2012 with DPW and ADPC as partners. The initiative focuses on managing inter port traffic safely and securely. Ships, routing systems, commonly called 'Traffic Separation Schemes' (TSS) have been established to improve safety of life at sea, safety and efficiency of navigation, and increase the protection of the marine environment.
The TSS is intended to formalise the traffic routing between two major UAE ports that are only 20 NM apart. Risks of collisions, pipeline and cable strikes and groundings are minimised by establishing the required interactions between ships and the ports and managing the port approaches feeder that ships take.

Risks of spills from collisions and the subsequent releases are minimised by managing the traffic flow much the same way shore side roads and traffic lights and signs manage vehicle traffic. In addition, the TSS program helps in lowering the risk of pollution and navigational accidents; providing a transparent process for ship routing; and increasing the utilisation of vessels traffic services (VTS) principals as a service provider to the client vessels.

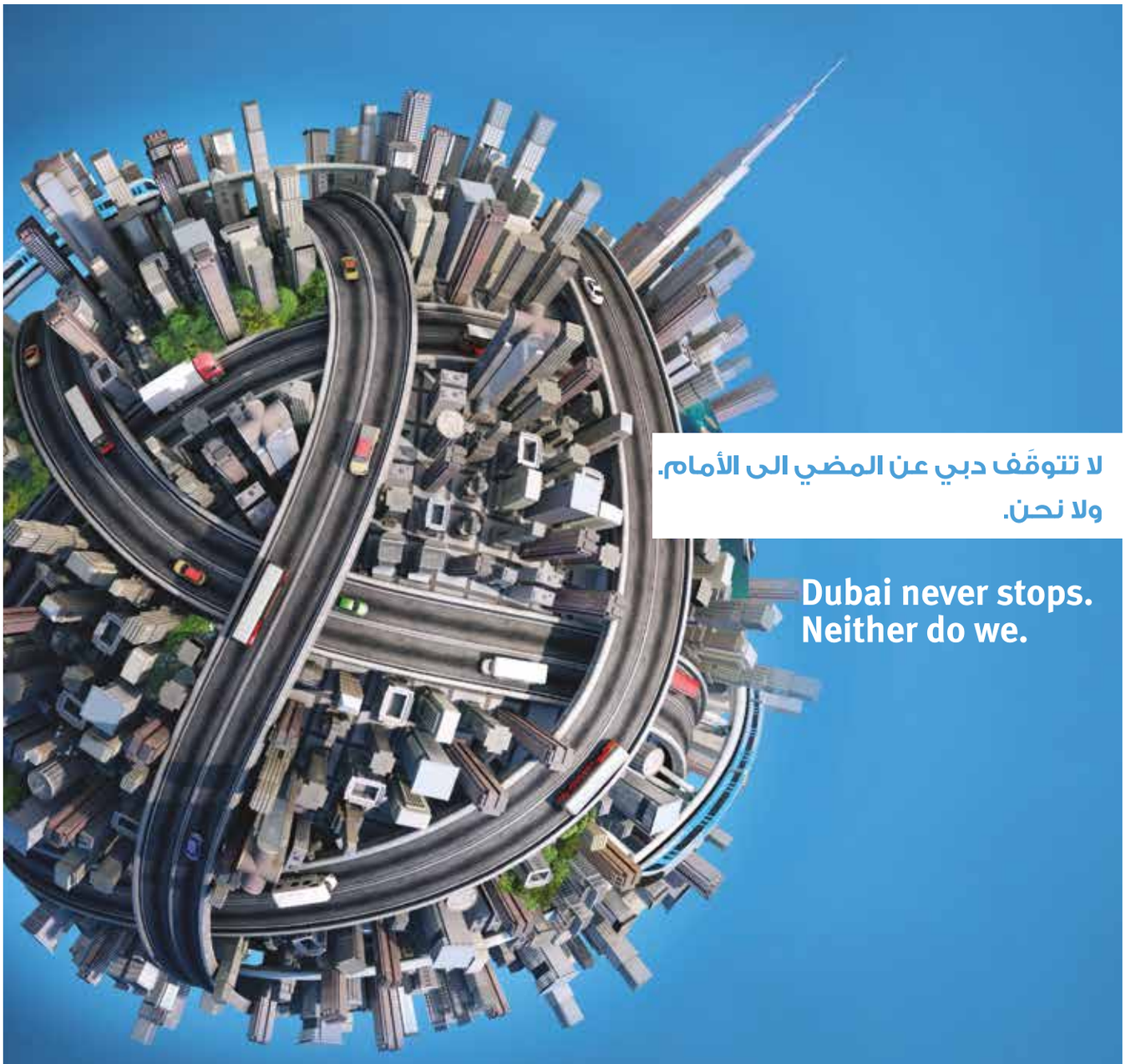
MSP is focused on increasing the understanding of the impact shipping has on the environment, our daily lives and our future. The program has several more modules that DMCA in cooperation with DSCE, will roll out with our private and public sector partners over the next five years. The modules – which will be developed in light of Dubai Maritime Sector Strategy, and in line with Dubai Strategic Plan, will explore innovative approaches to ensure that Dubai and the UAE remain leaders in the region and globally.

Did you know?

District cooling can reduce annual CO_2 emissions by approximately one ton for every ton of district cooling refrigeration demand served. The envisioned district cooling potential in the Middle East (cumulative total of 2.9 million tons of refrigeration demand by 2015) could reduce carbon dioxide emissions by about 2.8 million tons annually!

حكومة دبي
GOVERNMENT OF DUBAI

هيئة الطرق والمواصلات
ROADS & TRANSPORT AUTHORITY
RTA



لا تتوقَف دبي عن المضي الى الأمام.
ولا نحن.

Dubai never stops.
Neither do we.

منذ العام ٢٠٠٥، لم تدّخر هيئة الطرق والمواصلات جهداً فى سبيل تخطيط مستقبل والطرق، النقل، على أكمل وجه في واحدة من أسرع المدن نمواً في العالم... دبي.

واليوم، نمضي بكل ثقة لبناء نظام نقل متكامل من الطراز العالمي، بحيث يوفر سهولة فائقة في التنقل بين كافة أرجاء الإمارة، ويمهد الطريق نحو تحقيق رؤيتنا في توفير تنقل آمن وسهل للجميع.

Since 2005 RTA has been actively planning the future of roads & transport in one of the fastest growing cities in the world, Dubai.

We won't rest until we create a world-class integrated transport system capable of achieving Dubai's vision & serving the vital interests of the Emirate. RTA, safe and smooth transport for all.

معاً نبني مستقبل دبي
TOGETHER WE BUILD THE FUTURE OF DUBAI

EXPO 2020 إكسبو
دبي، الإمارات العربية المتحدة
DUBAI, UNITED ARAB EMIRATES

COMPANY PROFILES

هيئة كهرباء ومياه دبي
Dubai Electricity & Water Authority

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.

الاتحاد
Etihad
لخدمات الطاقة
Energy Services

Etihad Energy Services Co. started its operations in 2013 as a subsidiary of DEWA. Playing the role of Super ESCO (Energy Service Company), it enables the performance contracting market in Dubai by enhancing energy efficiency and demand side management in line with the objectives of the Dubai Integrated Energy Strategy 2030. Etihad Energy Services aims to jumpstart the creation of viable performance contracting market for ESCOs by executing building retrofits, increasing penetration of district cooling, building capacity of local ESCOs for private sector and facilitating access to financing them.

The creation of Etihad Energy Services Co. is in line with DEWA's strategic objective of promoting sustainability through environmentally friendly initiatives which will reduce Dubai's energy footprint. It is hoped that this development will create an industry that will help Dubai achieve the demand side targets set by the DIES strategy of 30% by 2030.

dubal
Dubai Aluminium

DUBAL operates one of the world's largest single-site primary aluminium smelters (> 1 million tonnes annually). Its Jebel Ali complex includes a 2,350 MW power station, large carbon plant, casting operations, water desalination plant, and other facilities.

High quality aluminum products are manufactured in three main forms: foundry alloy (automotive applications); billet (construction, industrial, transportation and automotive forging); and high purity aluminium (electronics and aerospace). Over 300 customers are served in about 57 countries, predominantly in Asia, Europe, MENA region and the Americas.

The company is renowned for maximising the health and safety people while reducing operational environmental impact; and investmenting in social and economic development. Direct employment is provided to approximately 3,800 people, of whom more than 65 per cent at senior management level are UAE Nationals.

DUBAL owns 50% of Emirates Aluminium ("EMAL") at Al Taweelah, Abu Dhabi; and has invested in joint venture bauxite/alumina projects in Brazil, Cameroon, and Guinea.

DUBAL's proprietary reduction technologies rank are superb. DX Technology is operational in a 40-cell potline at DUBAL's smelter; and the 756-cell EMAL Phase I. DX+ Technology has been licensed to EMAL Phase II (444 cells), currently being commissioned; and selected for Aluminium Bahrain's Line 6 Bankable Feasibility Study.

اينوك
ENOC

Established in 1993 as a wholly-owned company of the Government of Dubai, ENOC aims to promote the interests of its shareholders through the development of further downstream and upstream activities in the oil and gas sector and beyond, and to encourage the economic diversification of Dubai and the rest of the UAE.

ENOC's vision is to be a leading regional integrated oil & gas group that is highly profitable and socially responsible towards employees, the community and environment. Driving this vision, ENOC is committed to achieving sustainable development and highly profitable growth and serving the growing energy needs of Dubai.

ENOC 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. ENOC is also focused on meeting and exceeding customer expectations in terms of quality and service, and in maintaining high industry standards with respect to environment, health and safety.

ENOC actively participates in an increasingly broad range of business ventures. Its joint ventures with major international companies allow partners to pool their technology, know-how and expertise along with their resources to further their commercial success.

Since its inception, ENOC has been guided by its philosophy of quality and professional management based on modern business concepts for commercial success and sustainable growth. Today it is poised to engineer a new and challenging period of growth and diversity.

هيئة الطرق والمواصلات
ROADS & TRANSPORT AUTHORITY
RTA

Established in November 2005, the Roads and Transport Authority (RTA) in Dubai is a public entity with an independent corporate body and a legal capacity entitling it to engage in all dispositions and actions needed to realize its objectives. It is entitled, in this capacity, to contract with a third party, prosecute or be prosecuted. The RTA is government-owned entity based in Dubai and may open branches inside the emirate or beyond.

The RTA is responsible for planning and implementing the requisites of transport, roads & traffic, be it within the Emirate or an inter-city service, and providing an efficient and integrated transit system in a way that serves the vision and vital interests of the Emirate.

The RTA conducts necessary studies to set up and apply fees for roads, traffic and transport, including road network charges, drivers & vehicles licensing fees, and mass transit fares. It also commissions studies to improve legislations & procedures relating to the registration & licensing of drivers and vehicles in a way that realizes the strategic objectives of the transport system in the emirate, in addition to licensing mass transport routes, including all RTA-related licensing activities.

The RTA has a board of directors entrusted with overseeing the administrative, technical & financial affairs. The organization setup of the RTA consists of 5 agencies, namely: Traffic and Roads Agency, Public Transport Agency, Licensing Agency, Rail Agency, and Dubai Taxi Corporation, along with 3 support sectors, namely Strategy and Corporate Governance Sector, Corporate Administrative Support Services Sector, and Corporate Technical Support Services Sector.

COMPANY PROFILES

EMPOWER
ENERGY
SOLUTIONS

Emirates Central Cooling Systems Corporation -EMPOWER – a decree company established in 2003 as a joint venture between Dubai Electricity and Water Authority (DEWA) and Dubai Technology and Media Free Zone Authority (Tecom) to provide efficient District Cooling Services (DCS) to major developments in Dubai and Middle East.

EMPOWER is committed to provide its customers with a reliable and efficient energy source that enables buildings to operate at optimal performance levels. This translates into sustainable solutions for EMPOWER's customers.

It is projected that electricity demand across the Middle East Region is set to grow at between 5% and 12% per annum; the figures predict further and faster growth for the emirate of DUBAI based on its strategic geographic location and the scale and ambition of projects under construction.

Our VISION is To be the world's leading district cooling services provider

Our MISSION is To promote sustainable and optimized use of energy resources by delivering reliable, cost-effective and environmentally friendly world-class district cooling services to achieve customer satisfaction, thereby creating long-term shareholder value.

Emirates NBD 50 years

WHOLESALE BANKING

Emirates NBD is a leading banking Group in the region. As at 30th June 2013, total assets were AED 334.8 billion.

The Group has a leading retail banking franchise in the UAE, with 210 branches and over 901 ATMs and CDMs in the UAE and overseas. It is a major player in the UAE corporate and retail banking arena and has strong Islamic banking, Global Markets & Treasury, Investment Banking, Private Banking, Asset Management and Brokerage operations.

The Group has operations in the UAE, Egypt, the Kingdom of Saudi Arabia, Qatar, Singapore, the United Kingdom and Jersey (Channel Islands), and representative offices in India, Iran and China.

The Group is an active participant and supporter of the UAE's main development initiatives and of the various educational, environmental, cultural, charity and community welfare establishments.

بلدية دبي
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.

ABB

ABB is a global leader in power and automation technologies. Based in Zurich, Switzerland, the company employs 145,000 people and operates in approximately 100 countries. ABB has been present across the Middle East since 1926 with its first office in Cairo, Egypt. Today, ABB stands as the largest supplier of industrial motors and drives, the largest provider of generators to the wind industry, and the largest supplier of power grids worldwide. In the UAE ABB manufactures a range of power and automation products to serve rising local demand for increased electrical infrastructure. ABB has had a far reaching impact in the United Arab Emirates. Over the last few decades, the country has transformed into one of the world's leading regions of which ABB technology has been instrumental. ABB's solutions enable reliable power and energy efficient automation from the world's tallest tower, palm islands or driverless metro system right down to utilities and industrial sector; ABB's presence in the UAE has been far-reaching and it will continue to play a vital role in driving the country's infrastructure, projects and economy forwards, for many years to come.

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Praseeda Nair

Praseeda is a journalist with extensive field experience in sustainability across business sectors. Most recently, Praseeda has moderated a side event on climate change and the lower Gulf at COP 18 in Doha. She holds an honours degree in Literature from the National University of Singapore and Harvard.

Vesela Todorova

Vesela Todorova has eight years of UAE reporting experience and has spent the past six reporting on environmental issues. She has followed closely the development of some of the country's most exciting clean energy projects and also writes on energy efficiency, water management and biodiversity. She is currently the Environment Correspondent for The National newspaper in Abu Dhabi.

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