

PUBLISHED BY:



UNITED ARAB EMIRATES  
MINISTRY OF ENERGY

# UAE STATE OF ENERGY REPORT

2016



## THE UAE'S SUCCESS STORIES IN:

- STATE OF ENERGY
- ENERGY & THE CONSUMER
- ENERGY, ECONOMY & INDUSTRY
- CLIMATE CHANGE
- CLEAN & ALTERNATIVE ENERGY
- ENERGY & TRANSPORTATION
- FUEL & PETROCHEMICALS
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**THE UAE  
STATE OF ENERGY REPORT  
2016**







“

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

**HIS HIGHNESS SHEIKH  
KHALIFA BIN ZAYED AL NAHYAN**  
PRESIDENT OF THE UNITED ARAB EMIRATES





“

We recognise that preserving our energy resources will be one of the greatest challenges in our drive towards sustainable development. This, however, will not materialise unless the different facets of our society adopt energy conservation principles in their core values.

The future generations will be the chief beneficiary of our achievements and the best judge of what we accomplish in this field.

**HIS HIGHNESS SHEIKH  
MOHAMMED BIN RASHID AL MAKTOUM**

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



# FOREWORD

Energy is one of the most important drivers of the UAE's social and economic growth. Our wise leadership throughout our history has ensured the availability, affordability and reliability of energy sources through long-term planning and diversification. The UAE Ministry of Energy is the vehicle to ensure the governance and long-term planning of the whole sector. We realised the need to adopt more diverse energy sources with change to: a focus on cleaner and affordable sources of energy. That long-term planning and diversity has enabled the UAE to be a model for its neighbours and other countries in the world.

2015 has been an exciting year for us, as we continue progressing on our diverse energy sources projects. In Abu Dhabi, work on the Barakah nuclear power complex is progressing as planned with excellent HSE records. In September 2015, we achieved 70% completion on the first plant and 50% on the whole project of four nuclear plants. This milestone confirms that we are on track to achieve the 5400MW nuclear contribution, which is expected to cover 25% of our electricity demand by 2020.

In Dubai, bold new moves were made to increase Dubai's target renewable contribution to the Energy mix from 5-7% by 2030 to 25%, with the expectation of reaching 1000MW by 2020.

The 200MW solar PV tender, in Mohammed bin Rashid Al Maktoum Solar Park, broke records as the lowest solar PV cost in the world, with less than USD 0.06/kWh.

2015 also marks a historical move for the Ministry of Energy after deregulating fuel prices and linking them directly to international prices. This bold decision made the UAE the first country in the region to move away from subsidies, encouraging conservation and efficient use of energy resources.

As the UAE Government decided to dedicate 2015 to innovation, we worked with all of our stakeholders in the energy sector in the country to embrace technological advancement and innovations in specified segments of the sector.

Moving forward, we are keen to enable new technologies and promote R&D in certain areas of the sector, from generation to demand-side management. We will continue to work on our long-term UAE Energy Policy, accompanied by the required regulations to optimise energy conservation and reduce the impact on the environment. In the following pages, we highlight our experience in modernising our country's energy sector. We hope by sharing our success stories, we can inspire positive change in the energy sector.

**HIS EXCELLENCY  
ENG. SUHAIL AL MAZROUEI**

**MINISTER OF ENERGY, UAE**





The United Arab Emirates has shown dynamism in modernising government while preserving rich traditions.

I also applaud the Emirati Government for helping to advance progress on climate change and renewable energy.

ON THE OCCASION OF THE OPENING OF  
THE UAE GOVERNMENT SUMMIT, DUBAI  
UNITED ARAB EMIRATES,  
09 FEBRUARY 2015

**HIS EXCELLENCY  
BAN KI-MOON**

**SECRETARY-GENERAL,  
UNITED NATIONS**



The conversation around energy continues to be one of the most important global discussion topics. Energy will continue to play a vital role in powering our economic growth and development.

Achieving growth and ensuring our energy supply is sustainable is critically important for both the UAE and the global community.

In the UAE, our diversification efforts have enabled us to withstand the fall in oil prices, while still pursuing a balanced energy mix. A few examples of our efforts include increasing renewable capacity across the country and developing a peaceful nuclear programme.

This balanced approach to energy and economic diversification helps ensure our leadership and presence in future energy markets, positions us as a stable and reliable supplier and enables us to contribute to the region's long-term development. More importantly, it paves the way for continued economic growth and a sustainable, secure energy future for the UAE.

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**HIS EXCELLENCY  
DR. SULTAN AL JABER**  
MINISTER OF STATE, UAE  
CHAIRMAN OF MASDAR

The UAE has been taking a leadership role in the MENA region in transforming the national economy into a low-carbon, sustainable economy, which can achieve green objectives and economic growth simultaneously. Recognising the importance of achieving sustainable development, the country has already taken major steps to overcome the diverse environmental challenges arising from the record pace of growth in population, energy and water demand and urbanisation.

The UAE's successful economic development reflects the country's ability to address these vital environmental challenges, which have risen from the record pace of growth in population, energy and water demand and urban areas. In line with this, the country has decided to steer its course towards a green economy, in order to achieve green objectives and economic growth simultaneously by launching the UAE Green Growth Strategy under the slogan "Green Economy for Sustainable Development" which forms the UAE Green Agenda 2015-2030.

The UAE Green Development Council, which I am honoured to chair, will closely guide and oversee the implementation of the Green Agenda and stimulate effective actions and harmonisation of different policies through regular monitoring and reporting. In coming years, relevant national and local policies will be developed and reinforced in a more coordinated manner, wherein industries and citizens will be encouraged to come up with more eco-innovative solutions and adopt more environmentally sound behaviour using innovative ideas.

---

**HIS EXCELLENCY  
DR. RASHID AHMED  
BIN FAHAD**  
**MINISTER OF ENVIRONMENT  
AND WATER, UAE**





In the two years since its launch, the State of Energy Report has established itself as an excellent tool to showcase innovation in the UAE's energy sector.

Indeed, a lot has been achieved in the past few years as the country has turned away from reliance solely on fossil fuels to provide for its energy and water needs. The UAE Government decided that diversification and energy security are important strategic goals and many initiatives have followed that are aligned with these goals.

When it comes to deploying new, clean-energy production technologies, the UAE is the firmly established regional leader. It has also promoted a pioneering attitude in regards to planning and investments in energy efficiency.

The Ministry of Energy salutes the efforts of all local and federal entities that are helping build a sustainable future for the country. For its part, the Ministry is looking to provide strategic direction for the sector and a legal framework that will allow for success stories to be replicated quickly throughout the entire country. Innovation in the energy sector is one of the key requirements for the continued growth and prosperity of the UAE and the well-being of its citizens.

---

**HIS EXCELLENCY  
DR. MATAR  
AL NEYADI**  
UNDERSECRETARY  
OF THE MINISTRY  
OF ENERGY, UAE

The UAE leadership places great importance on the energy sector in its future strategy. The nation is lowering its contribution of hydrocarbons to the GDP, making the country less vulnerable to fluctuations in crude oil prices. Diversification of the economy and energy mix is at the core of the UAE's and Dubai's efforts to realise sustainable development.

Our leadership's goal is to make the country one of the world's best in energy policy and diversifying the energy mix, focusing on innovation in this sector. In line with the UAE Vision 2021, the UAE is adopting cutting-edge technologies to increase clean energy in its energy portfolio and to increase resource efficiency everywhere. Renewable energy represents a keystone of the UAE strategy to build new industries, reduce dependence on fossil fuels and ensure a long-term role in the global energy market, enabling green economy and green growth.

The Dubai Integrated Energy Strategy 2030 is driven by the vision of Dubai Supreme Council of Energy to make Dubai a role model to the world in energy security and efficiency.

Our work on the Mohammed bin Rashid Al Maktoum solar park is part of the Dubai Integrated Energy Strategy 2030 to diversify Dubai's energy mix so that 15% of Dubai's total power output will come from solar power, while 7% will come from clean coal, 7% from nuclear energy and the remainder from natural gas by 2030. Demand Side Management is the other aspect of this strategy, with a view to decreasing consumption by 30% by 2030.

Clean technology innovation is earning the UAE a reputation as a leading clean energy innovation hub in the region to help drive the global energy sector. This State of Energy Report covers the important milestones and achievements that have been made during the implementation of this integrated strategy, which is still unique amongst nations and cities in bringing together energy stakeholders together to deliver the best and most advanced infrastructure for Dubai. I trust you will find this both informative and inspiring.

---

## HIS EXCELLENCY SAEED MOHAMMED AL TAYER

VICE CHAIRMAN, DUBAI SUPREME COUNCIL OF ENERGY,  
MD & CEO, DUBAI ELECTRICITY AND WATER AUTHORITY



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# STATE OF ENERGY

## HIS EXCELLENCY ENG. SUHAIL AL MAZROUEI MINISTER OF ENERGY, UNITED ARAB EMIRATES



When the UAE began exploring non-traditional energy such as renewable energy and nuclear power, many were sceptical and did not believe much progress was possible. Yet the clear vision and strong support of our leaders encouraged us to achieve substantial developments within a very short time frame.

Recent years have proven the seriousness of our commitment towards creating these positive changes in the UAE energy sector. We believed in our vision, made tough decisions, felt confident in the steps we needed to take, and are proud to witness the results we have achieved so far. The positive experience witnessed by the UAE, is a testament to the importance of clear vision, strong leadership and commitment when implementing change in the energy sector.

However, as with any change, challenges arise. The UAE Ministry of Energy has moved swiftly to diversify the country's energy sector, yet the rising demand for power across the nation poses a major challenge, as well as the security of our limited resources in providing an adequate water supply to a growing nation. These are both pressing issues we must confront.

The UAE Ministry of Energy is committed to facing these challenges and proposing efficient solutions which will result in positive outcomes for the country. Our success is interdependent on the calibre of people we employ in the energy sector, who have the ability to carry out their roles in the highly skilled and highly technical jobs that are a fact in this industry. We have pushed towards adopting solutions that endorse clean energy and new technology, whilst simultaneously ensuring that we build the highest levels of capacity we can throughout the UAE's energy sector.

The steps we have taken have set us on a decisive path, forcing us to optimally utilise tools that ensure an abundant availability of energy resources. The oil and gas sector in the UAE, therefore, will continue to play a key role in our economy in the short to medium term, while the policies we are implementing will allow us to develop reliable, sustainable and affordable alternative energy resources for the country that will reduce our emissions and improve our carbon footprint. More specifically, thanks to the expansion of the Ruwais Refinery in Abu Dhabi, which is expected to be completed in the near future, the UAE will be able to meet the demand for refined products it currently seeks.

This search for alternative energies has led the UAE to recently accomplish a major breakthrough, when it was able to bid for new solar power generation at a cost even lower than conventional fossil fuels. Meanwhile, production of nuclear energy through the nation's sectors is also progressing to the point where we expect to meet 25% of the country's demand for power by 2020.

As a nation, we need to turn to a variety of resources in the search for alternative energy generation, allowing us to focus on creating solutions that offer the UAE clean, renewable, technological and cost efficient energy and move away from relying on fossil fuels.

The chapter that follows shows our experience, so far, in our efforts to move towards this goal.

# MARING THE TRANSITION

## HOW THE UAE IS MOVING TO NEW, SUSTAINABLE FORMS OF ENERGY USE



UNITED ARAB EMIRATES  
MINISTRY OF ENERGY



By H.E. Eng. Fatima  
Al Foora Al Shamsi

**"The UAE government wants to ensure sustainable development while preserving the environment, and to achieve a perfect balance between economic and social development."**

Quoted from the UAE Vision/Agenda 2021





The UAE is continuing with its transition towards the more sustainable energy forms of the future. A modern, sustainable and diversified energy mix is our goal, and all relevant stakeholders are committed to achieving it.

Building on the successes of the past, the UAE is developing its solar and nuclear energy capacity, while utility companies and government departments simultaneously implement demand-side management policies that ensure existing energy resources are used as efficiently as possible. The UAE government is determined to succeed, because modernisation of the energy sector is the key to our continued prosperity.

The goal of supporting modernisation and diversification of the energy mix is also the motivation behind the programmes and policies introduced by the Ministry of Energy. The UAE Vision 2021 seeks to achieve a sustainable environment and integrated infrastructure pertaining to water security, energy intensity, renewable energy and carbon-emission reduction. These goals are at the forefront of activities for the UAE water and energy sector's main players for the period until 2021, as they are for the Ministry of Energy's current work strategy, which covers the period until 2016. These goals will also direct the ministry's new strategy and outline its priorities for the period 2017 - 2021. The government entities (both federal and local) contributing to the UAE National Agenda 2021 are working together to achieve these goals, initiating projects that will have a direct impact on energy sources and their use in the UAE. 

**Progress has also been achieved at the policy level. In August 2015, a decision was implemented to remove fuel subsidies for vehicles**



## STATE OF ENERGY

A key area of focus is energy efficiency. In new buildings in Abu Dhabi, the Abu Dhabi Council for Urban Planning has introduced the "Estidama" programme where communities, apartment buildings and villas are classified according to the "Pearl system". The Pearl system encourages the more efficient use of water and energy and looks for improved waste minimisation, as well as the use of local materials and much shorter supply chains for sustainable and recycled materials and products. This approach is tied in to Abu Dhabi's development and building codes.

In Dubai, Dubai Municipality issued "The Green Building Code" which became mandatory from the beginning of March 2014, to include all new buildings in the Emirate. In Ajman, Green Building Standards are under development by the Green Building Committee within the Ajman Municipality and Planning Department. At the federal level, a national committee has been formed for a unified UAE building code which is to be based on international best practice.

The government has recognised that energy efficiency in buildings should not be limited to new buildings. Retrofitting of existing buildings is one of the quickest ways to reduce overall energy intensity and provide opportunities for green business. Starting with federal government buildings, there will be a new programme of building retrofits that will include schools, hospitals and mosques as phase one of the project. The ultimate aim is to improve the energy performance of all such buildings.

Progress has also been achieved at the policy level. In August 2015, a decision was made to remove fuel subsidies for vehicles. The move is expected to have positive economic, social and environmental impacts. Legislation is also being prepared to regulate the trading of oil products and prevent smuggling.

While oil and gas exports are vital to the UAE economy, the country has recognised the value of adding renewable energy to its energy mix. Among a number of landmark sustainability achievements during the first half of 2015, were a record low kWh price for the new 200MW solar photovoltaic plant announced by the Dubai Electricity and Water Authority (DEWA) in January. The tendering process achieved a tariff of USD .0584 per kWh later reduced to USD .054 for the clean power produced by the plant. At the time, this was the lowest tariff quoted by a solar photovoltaic project anywhere in the world. Saudi Arabian power and water company Acwa Power will partner with DEWA to build the plant.



By 2021, the UAE aims to increase the real annual economic growth of all sectors except oil by a further 5%





Attention is also being paid to small-scale solar power systems. Early this year, DEWA launched its first smart initiative, Shams Dubai, which will regulate the generation of solar power by residential and commercial users. For the first time, the system makes provisions for such energy to be fed into the grid and creates incentives for building owners to install solar power installations within their premises and therefore become their own power suppliers.

The UAE is also progressing with its plans to develop peaceful nuclear energy. In Abu Dhabi, Barakah 1, the country's first nuclear reactor, is nearing completion and will enter commercial operations in 2017. By 2020, the UAE will have four reactors, each with gross electric output of 1,400MW. ↗



### ABOUT **H.E. ENG. FATIMA AL FOORA AL SHAMSI**



H.E. is the Assistant Undersecretary for Electricity in the United Arab Emirates Ministry of Energy, with a rich background ranging from electrical engineering, renewables, business development and project management to different managerial roles and in action she is the Chairman of the Board of Directors of GCC CIGRE and a member of the board of directors of Emirate Authority for Standardization & Metrology (ESMA).

She also worked as the Vice President of Privatisation and Business Development in Dubai Electricity and Water Authority (DEWA) and as an Executive Director for Electricity in the Federal Electricity & Water Authority (FEWA).



Another area where the UAE is focusing significant attention is the link between the power and water sectors. The energy-water nexus has become the focal point for experts globally. Many are recognising how growing populations and climate change are likely to put additional strain on water resources, which are in turn vital for the operation of electrical power plants, mostly in terms of cooling needs but also in the case of hydropower.

This link between water and energy is extremely important in the UAE, which is one of the most water-scarce countries in the world. In the UAE, as in the rest of the Gulf, the generation of potable water

is directly linked to the availability of affordable and reliable energy-generation capacity. More than 90% of potable water in the UAE is produced in desalination plants. Traditionally, the UAE focused on thermal technologies used in desalination plants coupled with gas-fired electricity generation. The Ministry of Energy is currently working on a new water strategy that will consider the diversification of desalination technologies and water resources.

The Ministry's actions on the international scene also deserve attention. Officials represented the UAE at the Clean Energy Ministerial, a high-level global forum, as well as the Global

Sustainable Cities Network, and engaged with a number of counterparts from Europe and Asia.

The UAE has issued three national communications to the United Nations Framework Convention on Climate Change (UNFCCC), and is currently preparing a fourth submission. The report will contain important updates on the country's greenhouse-gas emissions. Classified as a developing country (non Annex 1 under the Kyoto Protocol), the UAE is not obliged to commit to targets to reduce emissions but it does account for them and continues to communicate on the subject with the international community. ■

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**Early this year, DEWA launched its first smart initiative, Shams Dubai, which will regulate the generation of solar power by residential and commercial users**

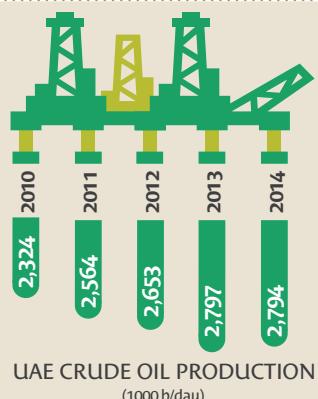
# UAE ENERGY SECTOR IN FIGURES

## CRUDE OIL & NATURAL GAS

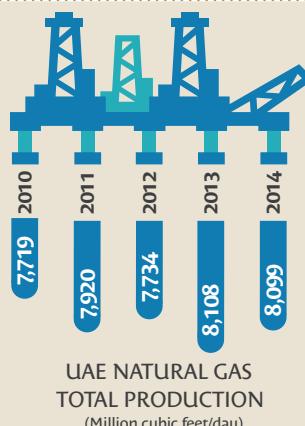
### UAE EXPORTS & IMPORTS OF NATURAL GAS & CRUDE OIL (billion cubic feet/year)



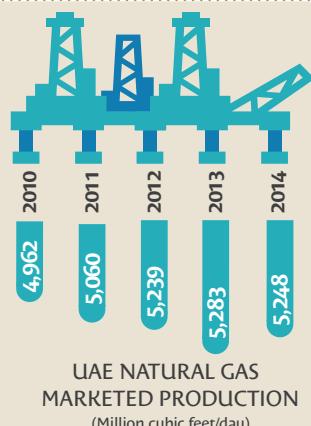
### UAE CRUDE OIL PRODUCTION (1000 barrel/day)



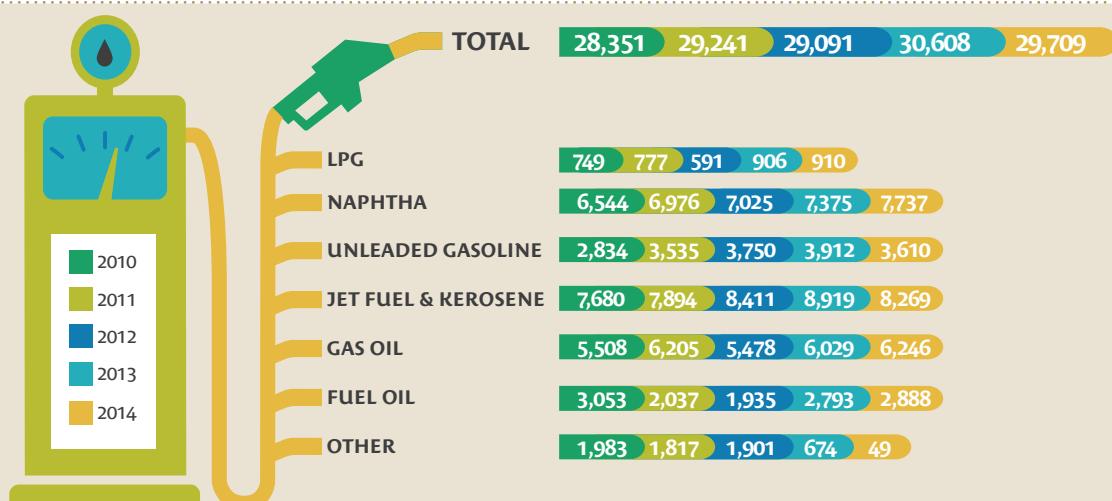
### UAE NATURAL GAS TOTAL PRODUCTION (million cubic feet/day)



### UAE NATURAL GAS MARKETED PRODUCTION (million cubic feet/day)



### UAE REFINERIES PRODUCTION OF PETROLEUM PRODUCTS BY PRODUCT (1000 metric ton/year)



**Note:** The size of bars is not proportional to actual values. It is for illustration purpose only.

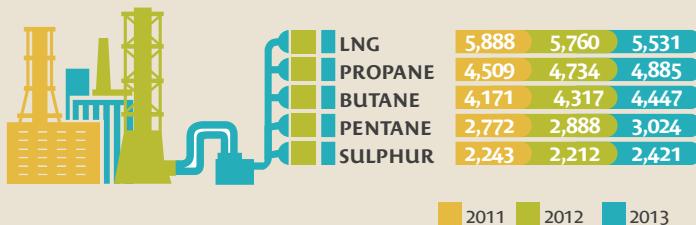


UNITED ARAB EMIRATES  
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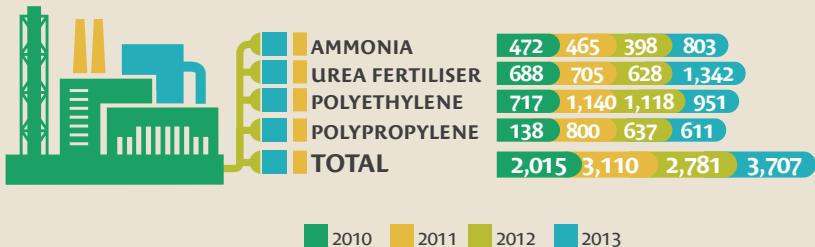
## UAE REFINERIES INPUT QUANTITIES BY TYPE (1000 barrel/day)



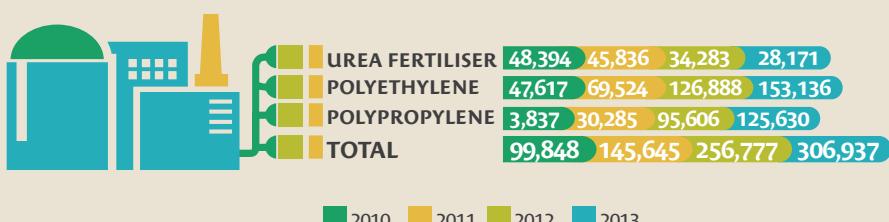
## ABU DHABI'S PRODUCTION OF LIQUEFIED NATURAL GAS & ITS PRODUCTS (1000 metric ton/year)



## PETROCHEMICAL PRODUCTS PRODUCTION (1000 metric ton/year)



## ABU DHABI SALES OF PETROCHEMICAL PRODUCTS (metric ton/year)



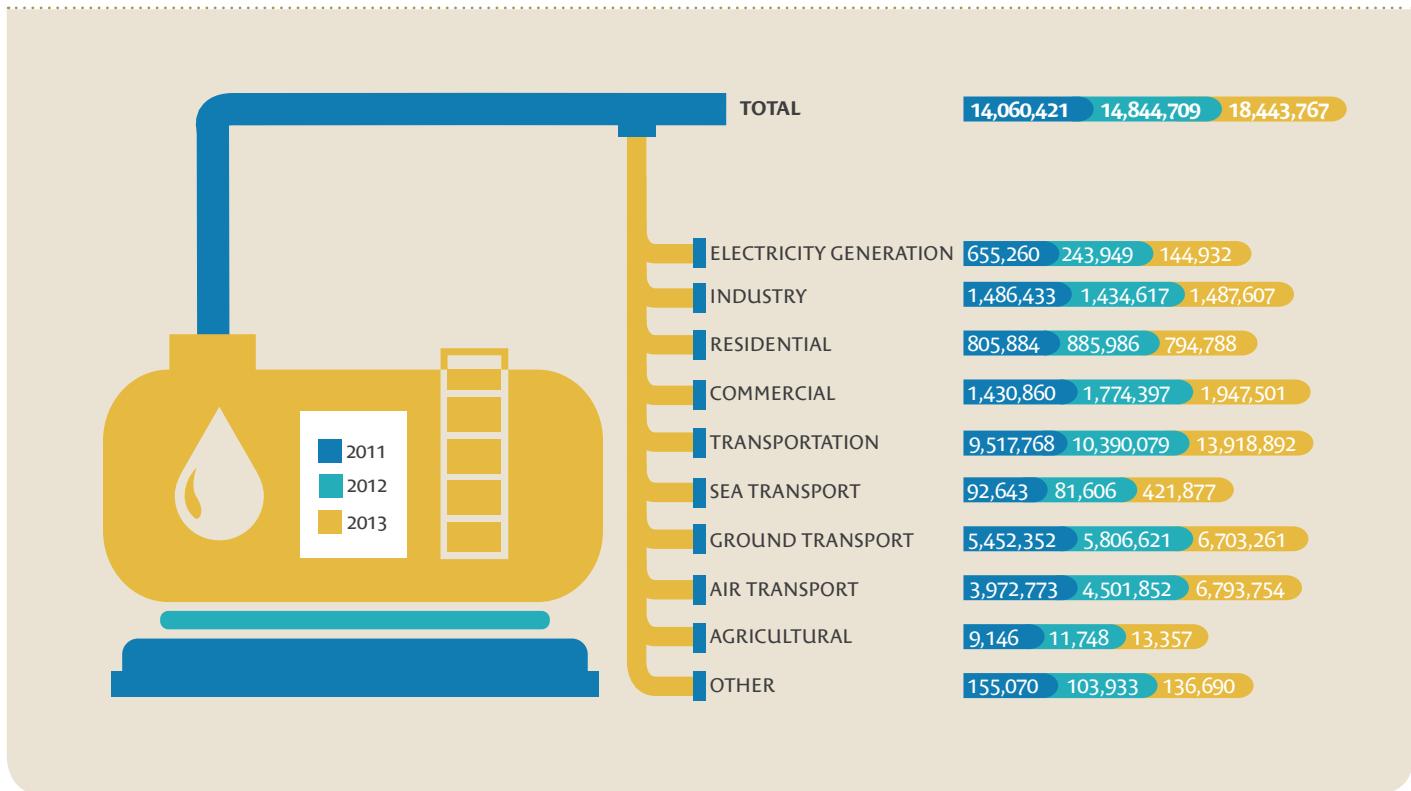
## WORKERS IN THE PETROLEUM SECTOR (Workers in ADNOC-ENOC-Emarat)



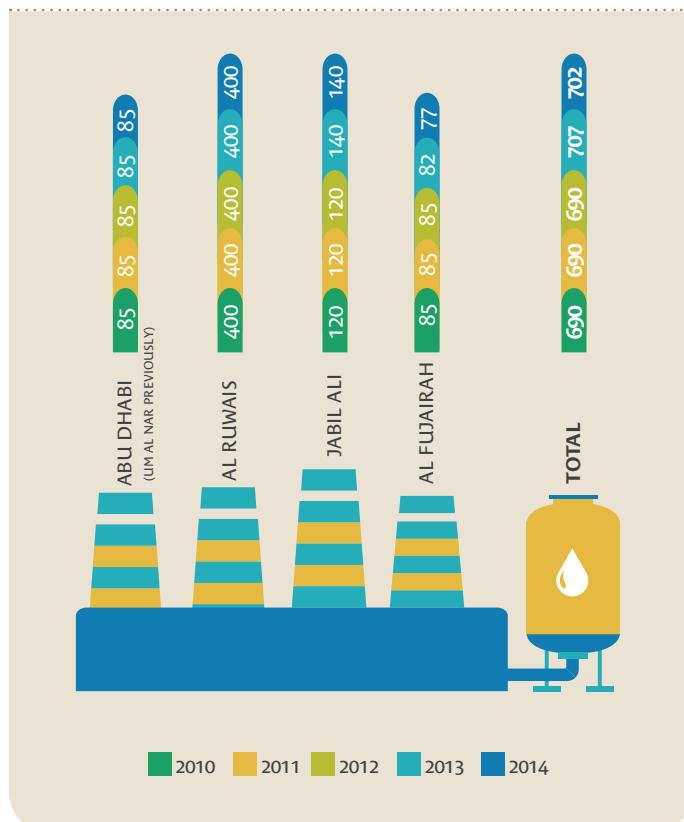
	2010	2011	2012	2013
NO DATA AVAILABLE				
2010				
2011				
2012				
2013	10,379	44,179	54,558	53,525
MALE				
FEMALE				
TOTAL	11,253	47,312	58,565	

MALE  
FEMALE  
TOTAL

## UAE sectoral consumption of petroleum products (metric ton/year)

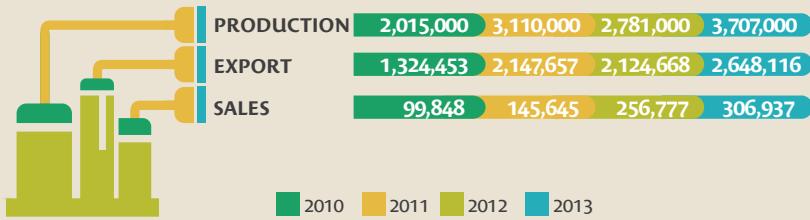


## UAE refineries capacity (1000 barrel/day)

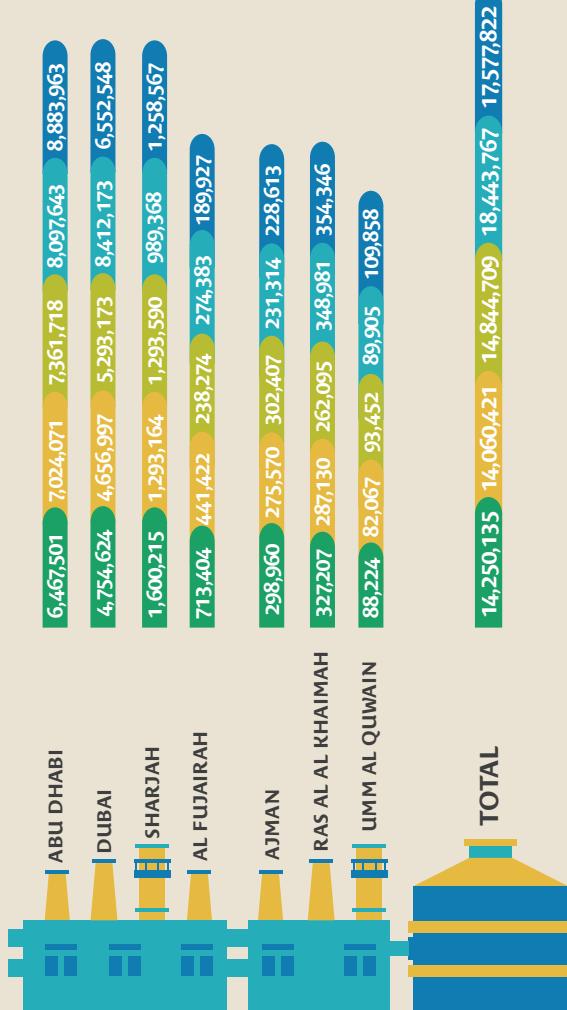


**Note:** The size of bars is not proportional to actual values. It is for illustration purpose only.

## UAE Petrochemical products (metric ton/year)

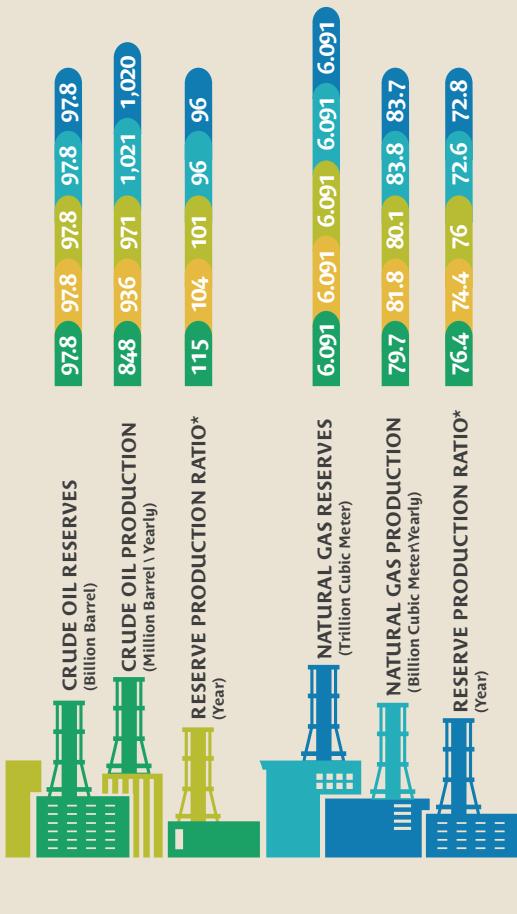


## UAE total sales of petroleum products by Emirate (1000 metric ton/year)



■ 2010 ■ 2011 ■ 2012 ■ 2013 ■ 2014

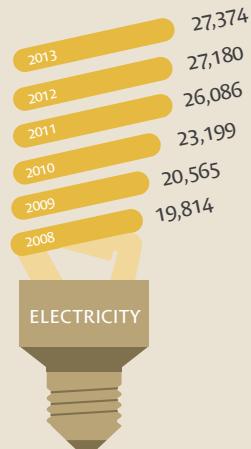
## UAE proven crude oil & natural gas reserves \* reserves \ production



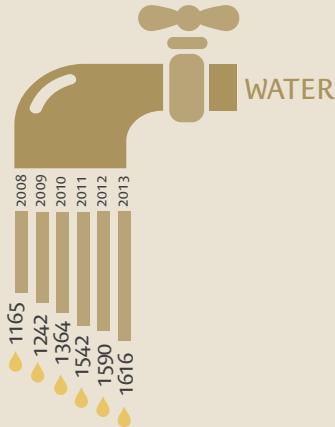
■ 2010 ■ 2011 ■ 2012 ■ 2013 ■ 2014

## STATE OF ENERGY

### Capacity Installed



ELECTRICITY INSTALLED CAPACITY - MW

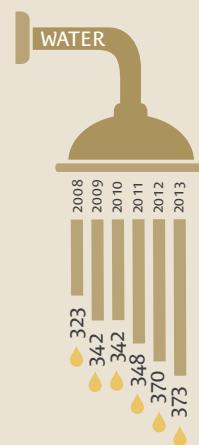


INSTALLED DESALINATION CAPACITY - MIG/DAY

### Consumption



ENERGY CONSUMPTION - TWH



WATER CONSUMPTION - MIG/Year

### Peak Load



PEAK LOAD - GW



PEAK WATER DEMAND - MIG/DAY

**Note:** The size of bars is not proportional to actual values. It is for illustration purpose only.

# TIME FOR ACTION

## HOW TO SOLVE THE ENERGY TRILEMMA, AS THE WORLD NEEDS AN AMBITIOUS CLIMATE FRAMEWORK IF GOALS ARE TO BE MET

**Energy business leaders could not be clearer: the time is ripe for action on climate change which requires the right capabilities, expertise and commitment. But for negotiation to give way to implementation, clear policy direction and consistent targets are essential.<sup>1</sup>**

Extensive research into the views of leaders across the globe and across all energy sectors reveals a renewed sense of urgency to move forward. A prolonged period of uncertainty is weighing on the industry at this point in the commodities cycle, at which it can ill afford to be buffeted by strong and volatile policy crosswinds. It is one of the issues cited by industry leaders as the most critical of those affecting them.

The International Energy Agency (IEA) estimates that up to USD 53 trillion of investment in energy infrastructure is required by 2035 to meet the “two degree goal” set by governments in the 2009 Copenhagen Accord.<sup>2</sup> Continued indecision is having a demonstrable impact on the prospects for securing this investment. The longer it persists, the more difficult it will become to ensure that the right energy

infrastructure and technology is in place to sustain a successful energy transition. The urgency is underlined not only by the hardening science on climate change, but also by predictions of dramatic changes in global energy demand.

Asia is set to produce almost 50% of global economic growth by 2050, with its share of primary energy consumption rising to between 45 and 48% of the global total. The Middle East and North Africa will continue to be heavy users of energy – their economies are set to triple by 2050, stimulating a doubling in energy demand over the same period. Despite European GDP doubling over that period, local energy demand will remain largely unchanged owing to improved energy efficiency. The picture is similar in North America.<sup>3</sup>



ARTICLE

By  
Joan MacNaughton



**The Middle East and North Africa will continue to be heavy users of energy – their economies are set to triple by 2050**



**The World Energy Trilemma**  
(...) assesses countries' energy policies against the goals of energy security, energy equity (affordability and access) and environmental sustainability

As the world begins to focus on the implications of a potential climate agreement at COP21 in Paris – and as the pessimists brace themselves for the consequences of another failed set of negotiations – the energy industry is keen to position itself as an enabler of the transition towards a lower carbon energy mix.

The 2,500 energy leaders who guided our work on the World Energy Trilemma – which assesses countries' energy policies against the goals of energy security, energy equity (affordability and access) and environmental sustainability – backed five major measures to make real progress: setting a carbon price to level the playing field; removing barriers to trade and enhancing the transfer of technology; a step change in research, development and demonstration; providing the right policy signals and a pipeline of bankable projects for investment to flow; and a greater focus on energy demand.

Those mechanisms, though, stand only a limited chance of success without a transparent and consistent target for emissions. That target should be easily monitored, but also be flexible enough to meet the specific circumstances of countries as they evolve. Success, however, hinges on policymakers fostering a culture of greater collaboration with industry and the investment community to ensure that targets are achievable and that implemented measures

contribute to meeting them. This is why the report does not just call for action but also sets out clear steps to take, in order to enable the energy sector to play its full part in the energy transition.

The sector must also engage proactively in the debate. With communities apprehensive about the impact of new technologies on affordability, the onus is on our industry, supported by the right policy platforms, to help develop better public understanding of the challenges of climate change and the implications of various approaches to meeting them.

The way we deliver and use energy has to change, but until we get the environment, energy and commerce ministers in one room, we will not achieve readily implementable climate decisions. Negotiation must now turn to vigorous implementation. It is a message we are hearing loud and clear: it is time to get something done.



**As the stakes rise ahead of COP21, the World Energy Council's World Energy Trilemma Study Group assesses countries' energy policies against the goals of energy security, energy equity (affordability and access) and environmental sustainability – and identifies five major measures to make real progress. ■**



FACT BOX

## WHAT IS THE “WORLD ENERGY TRILEMMA”?

The World Energy Council’s definition of energy sustainability is based on three core dimensions:

- **Energy Security**
- **Energy Equity**
- **Environmental Sustainability**

These three goals constitute a trilemma, entailing complex interwoven links between public and private entities, governments and regulators, economic and social factors, national resources, environmental concerns, and individual behaviours. Delivering policies which simultaneously address energy security, universal access to affordable energy services and environmentally sensitive production and use of energy is one of the most

formidable challenges facing government and industry. As part of the World Energy Trilemma process, the WEC in partnership with the global management consulting firm Oliver Wyman has developed the Energy Trilemma Index<sup>45</sup>. The Index index captures and aggregates country level data to outline the relative energy performances and contextual attributes of almost 130 countries. It provides a comparative ranking of countries’ ability to provide a stable, affordable and environmentally sensitive energy system, while highlighting current challenges. The findings of the Index analysis are complemented with individual WEC member country profiles. Find more information on

<https://www.worldenergy.org/data/trilemma-index/>



FOOTNOTES

- 1| World Energy Council, Oliver Wyman, 2015: World Energy Trilemma: Priority actions on climate change and how to balance the trilemma
- 2| International Energy Agency, 2014: World Investment Outlook
- 3| World Energy Council, 2013: World Energy Scenarios: Composing energy futures to 2050
- 4| [http://www.oliverwyman.com/insights.htm#industry\\_energy](http://www.oliverwyman.com/insights.htm#industry_energy)
- 5| <https://www.worldenergy.org/data/trilemma-index/>

### ABOUT JOAN MACNAUGHTON



She is the Executive Chair of the World Energy Council’s World Energy Trilemma report, and a former Director General general of Energy in the UK. She is also Chair of the International Energy Agency and remains an influential figure in the energy and climate debate internationally.



It is a message we are hearing loud and clear: it is time to get something done

# WORLD ENERGY TRILEMMA INDEX: THE UNITED ARAB EMIRATES

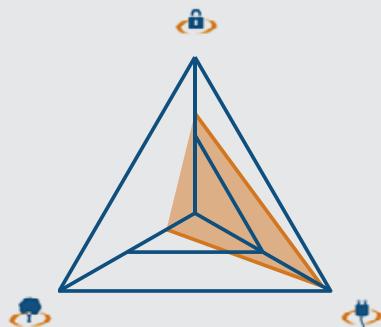
## STATE OF ENERGY

35 RANK

UNITED ARAB EMIRATES

SCORE ABD

### TRILEMMA BALANCE



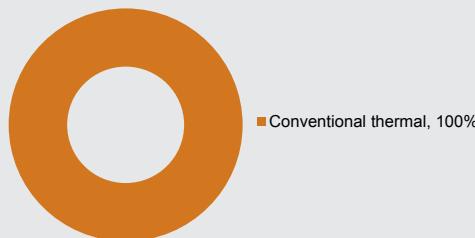
### INDEX RANKINGS AND BALANCE SCORE

	2012	2013	2014	Trend	Score
Energy performance	67	62	47	↑	B
Energy security	56	49	47	↑	B
Energy equity	39	37	8	↑	A
Environmental sustainability	106	102	102	↑	D
Contextual performance	24	22	32	↓	
Political strength	38	39	35	→	
Societal strength	33	33	34	→	
Economic strength	13	11	45	↓	
<b>Overall rank and balance score</b>	<b>53</b>	<b>44</b>	<b>35</b>	<b>↑</b>	<b>ABD</b>

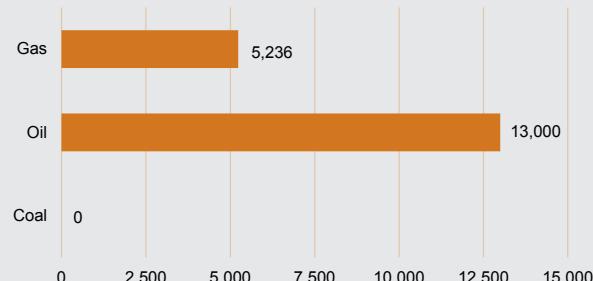
### INDEX COMMENTARY

The United Arab Emirates continues the positive trend of previous years and moves up another nine places to an overall Index position of rank 35. Well-endowed with plentiful deposits of oil and natural gas, the UAE maintains an above average energy security ranking. The country's energy equity performance is easier to measure in 2014 because data points used to calculate the affordability of gasoline are available for the first time. Compared to other countries, prices for gasoline are very affordable. Similarly, electricity remains affordable and of high quality. Environmentally, emissions intensity and emissions from electricity generation are high given that the UAE's electricity mix is still 100% fossil fuel-based. The Emirates' first nuclear power plant becomes operational in 2017, and solar power projects and increased efforts to raise awareness around energy efficiency are likely to improve the UAE's energy security and environmental sustainability performances in the coming years. Contextually, the UAE continues to perform well with strong indicators across the board.

### DIVERSITY OF ELECTRICITY GENERATION



### FOSSIL FUEL RESERVES (IN MTOE)



### KEY METRICS

Industrial sector (% of GDP)	61.1	GDP per capita (PPP, USD); GDP Group	29,176 (II)
TPEP / TPEC (net energy exporter)	2.16	Energy intensity (koe per USD)	0.20
Emission intensity (kCO <sub>2</sub> per USD)	0.49	CO <sub>2</sub> emissions (tCO <sub>2</sub> ) per capita	19.83
Energy affordability (USD per kWh)	-	Population with access to electricity (%)	94.1

### TRENDS AND OUTLOOK

- The UAE is making major investments across the energy spectrum to improve environmental sustainability. Of particular note among specific actions are: 1) construction of 5.4 GW of nuclear power, managed under one of the most internationally transparent programmes to date, which is on schedule to deliver the first reactor in 2017 and the last in 2020; 2) enactment in 2010 of Estidama, the first mandatory building and landscaping sustainability regulations (energy/water performance) in the Middle East, which is set to cut consumption by over one third from the baseline; 3) establishment of renewable energy targets, including 7% generation capacity in Abu Dhabi by 2020 and 5% consumption in Dubai by 2030 that will be met with solar, wind, and waste-to-energy; 4) establishment of 30% demand reduction target by 2030 in Dubai, achieved through a mix of pricing reforms, performance codes, and efficiency investments; 5) development of commercial-scale carbon capture and sequestration project by Masdar and ADNOC; 6) completion of the region's first carbon inventory in 2013 for Abu Dhabi and Dubai, to be extended to Northern Emirates; and 7) development of the MENA region's first green growth plan, released in 2013 in partnership with GGGI and includes policy steps for all major economic sectors to minimise the environmental impact.
- The UAE also has an extensive overseas clean energy investment portfolio, which includes: the establishment of a US\$350 million concessional loan facility for renewable energy projects in developing countries in partnership with IRENA; a US\$50 million grant for renewable energy projects in Pacific island countries; and other significant grant renewable energy projects.

# 2016 EVENT CALENDAR

The energy sector and sustainable development therein is discussed at various national and international forums. See below a list of events that you could attend and learn more.

EVENT NAME	VENUE	DATE	WEBLINK
META Projects	UAE - Dubai	26-27 of October 2015	<a href="http://goo.gl/WbLIFb">http://goo.gl/WbLIFb</a>
Sustainable Utilities Middle East Expo	UAE - Dubai	28-29 of October 2015	<a href="http://goo.gl/kRzuBD">http://goo.gl/kRzuBD</a>
Abu Dhabi International Petroleum Exhibition and Conference	UAE - Abu Dhabi	9-12 of November 2015	<a href="http://goo.gl/S103Ho">http://goo.gl/S103Ho</a>
MENA Clean Energy Forum	UAE - Dubai	16-18 of November 2015	<a href="http://goo.gl/CoAjJ9">http://goo.gl/CoAjJ9</a>
Middle East Smart Lighting & Energy Summit	UAE - Abu Dhabi	23-24 of November 2015	<a href="http://goo.gl/lLphxN">http://goo.gl/lLphxN</a>
Big 5 - International Building & Construction Show	UAE - Dubai	23-26 of November 2015	<a href="https://goo.gl/2D9yc3">https://goo.gl/2D9yc3</a>
Zayed Future Energy Prize Awards Ceremony	UAE - Abu Dhabi	18 of January 2016	<a href="http://goo.gl/AW9TAE">http://goo.gl/AW9TAE</a>
World Future Energy Summit	UAE - Abu Dhabi	18-21 of January 2016	<a href="http://goo.gl/3kCezb">http://goo.gl/3kCezb</a>
International Water Summit	UAE - Abu Dhabi	18-21 of January 2016	<a href="http://goo.gl/pQHm7m">http://goo.gl/pQHm7m</a>
EcoWASTE Exhibition	UAE - Abu Dhabi	18-21 of January 2016	<a href="http://goo.gl/CJ8TXI">http://goo.gl/CJ8TXI</a>
Egypt Energy and Environment Forum	UAE - Abu Dhabi	21 of January 2016	<a href="http://goo.gl/vlBxBQ">http://goo.gl/vlBxBQ</a>
The Festival at Masdar City	UAE - Abu Dhabi	23-24 of January 2016	<a href="http://goo.gl/5CHYbI">http://goo.gl/5CHYbI</a>
Middle East Electricity Exhibition	UAE - Dubai	1-3 of March 2016	<a href="http://goo.gl/nrV5Z4">http://goo.gl/nrV5Z4</a>
Solar Middle East Conference and Exhibition	UAE - Dubai	1-3 of March 2016	<a href="http://goo.gl/WdG4K2">http://goo.gl/WdG4K2</a>
Global Water Summit	UAE - Abu Dhabi	19-20 of April 2016	<a href="http://goo.gl/alilwU">http://goo.gl/alilwU</a>
Pollution Control and Sustainable Environment Conference	UAE - Dubai	25-26 of April 2016	<a href="http://goo.gl/9whbk0">http://goo.gl/9whbk0</a>
Water, Energy, Technology and Environment Exhibition	UAE - Dubai	4-6 of October 2016	<a href="https://goo.gl/yWOLVE">https://goo.gl/yWOLVE</a>
NATIONAL	Power Qatar Summit	Qatar - Doha	<a href="http://goo.gl/1TMVVc">http://goo.gl/1TMVVc</a>
	Asia Clean Energy Summit	Singapore - MBS	<a href="http://goo.gl/aV1x0T">http://goo.gl/aV1x0T</a>
	U.S. Solar Market Insight Conference	USA - San Diego	<a href="http://goo.gl/oC8ggM">http://goo.gl/oC8ggM</a>
	4 <sup>th</sup> West African Clean Energy and Environment Conference and Exhibition	Ghana - Accra	<a href="http://goo.gl/ATULkh">http://goo.gl/ATULkh</a>
	Intersolar India Conference and Exhibition	India - Mumbai	<a href="http://goo.gl/l3udyM">http://goo.gl/l3udyM</a>
	Kuwait Sustainable Energy Conference and Exhibition	Kuwait - Safat	<a href="http://goo.gl/zliAEn">http://goo.gl/zliAEn</a>
	Solar Canada Annual Conference and Exhibition	Canada - Toronto	<a href="http://goo.gl/ju5KnV">http://goo.gl/ju5KnV</a>
	Women in Energy Forum	SA - Sandton	<a href="http://goo.gl/mvqJC4">http://goo.gl/mvqJC4</a>
	Africa Solar Expo	SA - Sandton	<a href="http://goo.gl/16V5qc">http://goo.gl/16V5qc</a>
	Africa Renewables Expo	SA - Sandton	<a href="http://goo.gl/cYokQI">http://goo.gl/cYokQI</a>
	Africa Lighting Expo	SA - Sandton	<a href="http://goo.gl/JgNVGj">http://goo.gl/JgNVGj</a>
	Africa Energy Indaba Conference and Exhibition	SA - Sandton	<a href="http://goo.gl/qHnNN8">http://goo.gl/qHnNN8</a>
	East Africa Energy Forum	SA - Sandton	<a href="http://goo.gl/OixyCm">http://goo.gl/OixyCm</a>
	IPP & PPA Conference	SA - Sandton	<a href="http://goo.gl/Q1UdCh">http://goo.gl/Q1UdCh</a>
	Sustainable Built Environment Conference	Italy - Turin	<a href="http://goo.gl/p0yZNk">http://goo.gl/p0yZNk</a>
	International Conference on Ocean Energy	UK - Edinburgh	<a href="http://goo.gl/K2sPIS">http://goo.gl/K2sPIS</a>
	World Sustainable Energy Days Conference	Austria - Wels	<a href="http://goo.gl/NvNUOE">http://goo.gl/NvNUOE</a>
	The Big5 Saudi Exhibition	KSA - Jeddah	<a href="http://goo.gl/zEGB7R">http://goo.gl/zEGB7R</a>
INTERNATIONAL	Middle East Petrotech Conference and Exhibition	Bahrain - Manama	<a href="http://goo.gl/4ZDgzu">http://goo.gl/4ZDgzu</a>
	The Asian Conference on Sustainability, Energy and the Environment	Japan - Kobe	<a href="http://goo.gl/YY03LY">http://goo.gl/YY03LY</a>
	18th Annual Africa Energy Forum	UK - London	<a href="http://goo.gl/F9tJXf">http://goo.gl/F9tJXf</a>
	23rd World Energy Congress	Turkey - Istanbul	<a href="http://goo.gl/JQUgDv">http://goo.gl/JQUgDv</a>
	World Energy Day	Worldwide	<a href="http://goo.gl/J6ZMj3">http://goo.gl/J6ZMj3</a>
	Earth Hour	Worldwide	<a href="http://goo.gl/wPr66L">http://goo.gl/wPr66L</a>
	World Water Day	Worldwide	<a href="http://goo.gl/yus5YR">http://goo.gl/yus5YR</a>
	Earth Day	Worldwide	<a href="http://goo.gl/1fv0mf">http://goo.gl/1fv0mf</a>
	World Environment Day	Worldwide	<a href="http://goo.gl/bv7Tk1">http://goo.gl/bv7Tk1</a>

Note : Links are shortened and will take you to the event website for more information



INTERVIEW



**INTERVIEW:  
H.E. MATTAR  
AL TAYER**

**Director General, Chairman of  
the Board of Executive Directors,  
Roads and Transport  
Authority, Dubai**

**The Road and Transport sector  
is stepping up its game for  
sustainable development**

## DRIVING DUBAI

### Q1: Your Excellency, you have been heading Dubai Roads and Transport Authority since 2005, how has the authority's function within the Emirate of Dubai and its strategic focus evolved over the years?

**H.E. Mattar Al Tayer:** As Dubai grows, so does RTA. The entity's strategic goals are based on those of the Government of Dubai. RTA's main function is to develop an integrated and sustainable transportation system. Clearly, such a system is a main pillar for Dubai's competitiveness and economic advancement.

When RTA was established in 2005, initially it had a phenomenal and challenging task to deliver infrastructure and solutions to tackle the burgeoning traffic congestion by increasing the share of public transport from 6% in 2005 to 20% by 2020 and 30% by 2030 and thus achieve a greener economy. The other main challenge was to reduce road accident fatalities, which was then reported as around 22 fatalities per 100,000 of the population. This was quite a high rate in comparison to safety advanced countries in Europe where the death toll was 5 to 6 fatalities per 100,000 of population at that time.

I must say that we have made significant strides in terms of achieving our goals. The public transport ridership comprising the Dubai Metro, Dubai Tram, buses and marine transit modes (abras, ferries, water taxis, water buses), in addition to taxis (Dubai Taxi and franchise companies), topped 502 million riders in 2014, a 12.6% increase compared to 446 million riders in 2013. The average daily ridership of our integrated transport system in 2014 was 1.38 million riders per day, compared to an average of 1.2 million daily riders in 2013 and about one million riders in 2012.

The public-transport network in Dubai has become an essential element in serving the mobility and access needs of people across the Emirate. Our roads and transportation systems underpin the framework of the city and support its growth and development, further enhancing its competitiveness. Significantly, the share of public transport trips as a proportion of all motorised travel has increased from around 6% in 2005 to 14% in 2014.

With RTA's continuous effort to support Dubai becoming a sustainable city, RTA has carried out 32 energy-conservation initiatives and eight green-economy support initiatives. These initiatives are expected to achieve savings of about AED 17 million, covering various RTA sectors and agencies, contributing to saving power consumption in Dubai Metro stations and the tramway, reducing water consumption, improving road-lighting efficiency by using energy-efficient LED lighting, cutting down bus diesel consumption and slashing taxi fuel consumption in addition to reducing carbon dioxide emissions in 2013 by 41% compared to 2012.

In terms of road fatalities, we have seen a dramatic improvement from 21.9 fatalities per 100,000 population in 2006 to 3.9 per 100,000 in 2014, which is a staggering 82% drop. Moreover, there has been a significant drop in the rate of pedestrian fatalities from around 9.5 per 100,000 population in 2007 to as low as 1 fatality per 100,000 population by the end of 2014.

RTA is committed to investing in new, smart technology as part of its contribution towards achieving the Dubai Government's vision of becoming the smartest city. It plans to do this by leveraging internal and external capabilities of the Cloud, internet and everything, from analytics to social media, mobile and other systems. RTA is in a unique position to significantly contribute towards the happiness of Dubai's citizens and visitors.

RTA has launched 10 smart apps, which include:

1	RTA Dubai	2	Smart Parking	3	Smart Drive	4	Smart Salik	5	Wojhati
6	Smart Taxi	7	Drivers and Licensing	8	Public Transport	9	Sharekni	10	Corporate Services

There are 173 smart services launched under these apps. These applications use business as well as technical solutions that enable RTA customers to access RTA services from anywhere, at any time, and deliver a superior user experience.

At the same time, RTA recognises the importance of social media and the empowerment of customers and their need and desire for social collaboration and engagement. This is at the top of the agenda for RTA. Being able to ask and obtain real-time feedback at multiple levels of interaction, and further, analysing data and going back to the public with a meaningful response making use of the latest technology in social-media interaction analysis and customer-relationship management tools will help us better understand and meet our customer aspirations.

RTA will continue to invest in new technology and will always be a front-runner in adopting new technology, transitioning to a full customer-centric business model, where all interaction with the public is personalised, unobtrusive, fast and efficient.

RTA believes deeply in H.H. Sheikh Mohammed's vision that the UAE Government can make its citizens and visitors to Dubai happy at all times and its actions are a direct result of such inspirational leadership. 



The RTA launched 10 smart apps (...) with 173 smart services

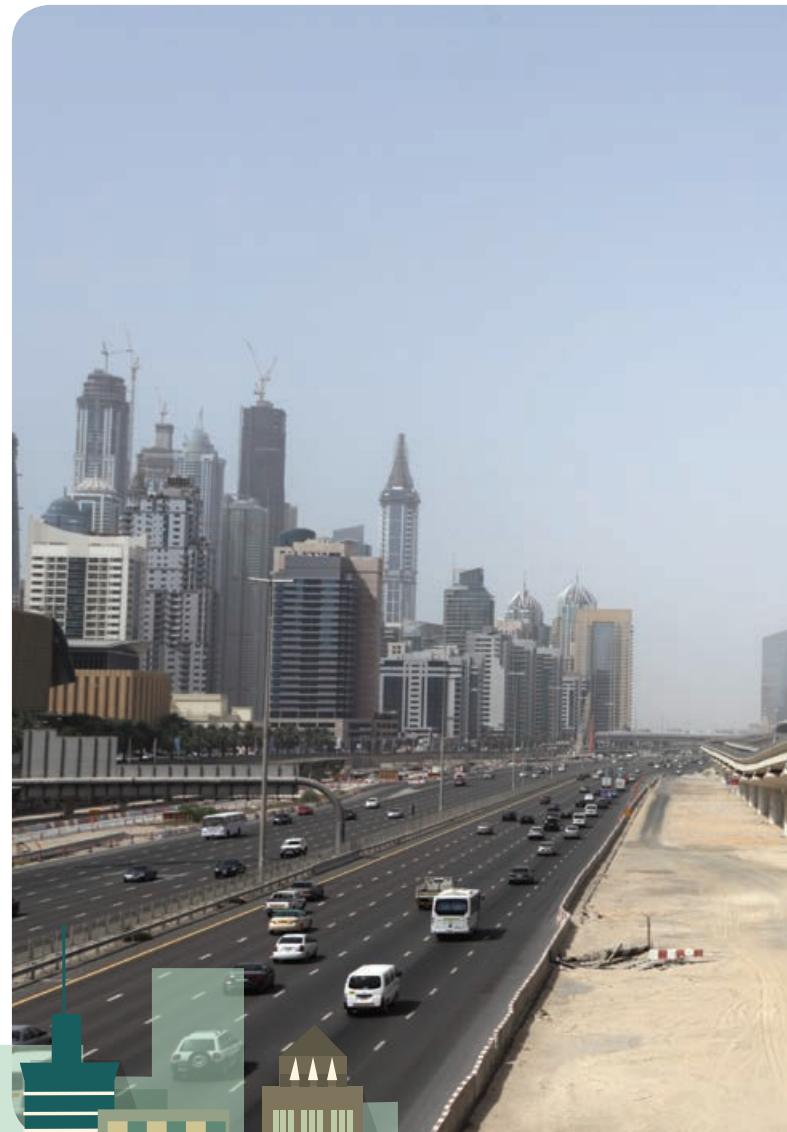
**Q2: The RTA joined the Dubai Supreme Council of Energy as a new member in 2014. Where do you see dependencies between the energy and the transport sector?**

**H.E. Mattar Al Tayer:** RTA plays an important role in the Dubai Supreme Council of Energy, since RTA is the regulator for the public-transport sector in Dubai. The road transport sector is one of the four sectors that were targeted in the Dubai Carbon Abatement Strategy and RTA is the nominated Leading Entity for this sector.

Also, RTA has an important role in the Demand-Side Management Programme of Dubai, as it is the owner of one of the eight elements of the DSM Programme; namely element no. 6: Outdoor Lighting.

RTA, based on the above, is in continuous coordination with the Dubai Supreme Council of Energy through RTA's membership in their technical sub-committees in this regard.

Moreover, RTA is implementing Directive No.1/2015 from the Dubai Supreme Council of Energy regarding the reduction of energy consumption in government buildings by 20% by 2021. The directive supports RTA's approach in building management in line with ISO 50001 certification, which aims to optimise energy consumption in government buildings and facilities by applying the latest technology.



**The Road Transport Sector is one of the Four Sectors that were targeted in the Dubai Carbon Abatement Strategy and RTA is the nominated Leading Entity for this Sector**





### Q3: Which RTA initiatives have an impact on, or are a result of Dubai's energy management?

**H.E. Mattar Al Tayer:** Beside RTA's major contribution in cutting carbon emissions in the Emirate of Dubai via the provision of public transportation, RTA has numerous major environmentally friendly energy-efficient projects at the Emirate level, such as the Dubai Metro, Dubai Tram, Electric Marine Transport, using more environmentally friendly fuel in public-transport buses, hybrid taxis, developing smart applications and more.

The RTA LED Street Lighting Project is part of the Dubai Demand Side Management Programme 2030, which aims to use more energy-efficient lighting fixtures.

RTA's journey towards energy management started much earlier, when it added environmental sustainability as a key element in its strategic plan in 2008. This journey has continued through the years to today, where we have the RTA integrated Energy and Green Economy Plan that sets RTA's direction toward the green economy and energy conservation.

### Q4: Do you personally see a future for electric (hybrid) vehicles in Dubai in the short and medium term?

**H.E. Mattar Al Tayer:** The current reach poses a problem for a city as far-spread as Dubai.

Regarding hybrid vehicles, RTA was one of the leading entities worldwide to deploy hybrid taxis in its taxi fleet, which started in 2008. The hybrid taxi project has proven positive environmental results, saving about 30% of CO<sub>2</sub> emissions compared

to normal taxis. RTA is conducting more research and studies to expand the use of hybrid taxis.

Also, RTA is working in collaboration with DEWA on the Pilot Project for Electric Vehicles Infrastructure Initiative as part of DEWA's Smart Initiatives. The results of the pilot project will determine future steps in this regard. 



**Q5: The Dubai Tram was inaugurated in late 2014, as the first of its type in the Middle East. With the experience of one year of operation under its belt, will the RTA commission trams in other parts of Dubai?**

**H.E. Mattar Al Tayer:** RTA has developed a comprehensive Rail Master Plan that can meet the future requirements of the expected urban and economic growth of Dubai. The planning and design of the rail network has been made flexible to accommodate future requirements and expansions, allowing for safe and smooth travel for all residents and visitors in the Emirate.

RTA is currently studying Stage 2 of the Dubai Tram, which will be extended roughly 5 kilometres, from the current location of the tram depot up to the Jumeirah Beach Hotel and Mall of the Emirates. The project is in the design stage.

**Q6: What are going to be the major changes in the way we get around Dubai in 2016 and for the next five years? What will be the game-changers?**

**H.E. Mattar Al Tayer:** As we head closer to preparing for Dubai Expo 2020, we can definitely look at 2016 being a year of meeting milestones. In terms of our major projects, which include the Dubai Canal project and the Parallel Roads Project, construction will be in full swing, as they are scheduled to be completed in 2017. Other projects include the construction of various internal roads and pedestrian crossings. In terms of our rail projects, construction of the Dubai Metro Red Line from Sheikh Zayed road to the Dubai Expo 2020 site and the Al Maktoum International Airport project are expected to start in quarter one of 2016 and be completed by December 2019. For the time being, the project has top priority in RTA's portfolio of projects, as it is planned to serve the Dubai Expo 2020 site, as well as existing and future developments along the proposed route.

During the coming few years, RTA will continue developing Dubai's transportation infrastructure and optimising the efficiency of that system. Areas that will receive more focus include the introduction of more smart services and applications, more personalised services, new technologies and increasing reliance on public transport.

RTA participated in formulating the Dubai Strategy "Dubai 2021" and will participate along with other governmental bodies in delivering the objectives of that strategy within the coming years. Throughout the RTA planning process, we ensure that the proposed initiatives and programmes all serve and integrate with the 2021 Vision of Dubai. ■

### ABOUT H.E. MATTAR AL TAYER



H.E. is the Director General, Chairman of the Board of Executive Directors, Roads and Transport Authority.

He is a professional civil engineer, graduated from the University of Wisconsin in 1983, and holds an Honorary Fellowship of the British Institute of Civil Engineers (ICE), 2010.

He was assigned the task of leading the Roads and Transport Authority in November 2005. Under his leadership and driving force, he established a competent and experienced specialist workforce, thereby driving the organization through remarkable achievements that have positioned RTA into a world-class organization.

Prior to taking the helm with RTA, H.E. M.A.L Tayer worked in Dubai Municipality starting in 1983, assuming several leadership roles and eventually moving as Deputy Director General of the Dubai Municipality.



INTERVIEW:  
**H.E. MOHAMMED  
MOHAMMED  
SALEH**

**Director General of the  
Federal Electricity & Water  
Authority (FEWA)**

**The Federal Electricity and Water  
Authority and its players in the  
framework of the UAE energy sector**

## ORCHESTRATING UAE'S UTILITIES



**Q1: Some of the seven Emirates are serviced by local authorities, some are not. What is FEWA's role in the energy and water supply of the UAE?**

**H.E. Mohammed Mohammed Saleh:** The Federal Electricity & Water Authority (FEWA) plays an important role in the energy and water supply of the UAE as it caters to the needs of the northern parts of the country. FEWA supplies six areas; Ajman, Ras Al Khaimah, Um Al Quwain, Fujairah, Dibba and Al Dhaid surroundings. Being committed to its clients, FEWA ensures that all services are delivered effectively and efficiently.

In addition, being active in society is a vital part of FEWA's corporate responsibilities. The authority continually provides people living within the society with outstanding services in both electricity and water, which enhances living quality. FEWA's services include applications for electricity and water connection services, approvals of technical drawings and clearance certificates to activation and disconnection services. FEWA strives to

provide these government e-services at a high standard to ensure satisfaction and comfort for customers.

In addition, FEWA co-operates and co-ordinates with others on strategic levels, which helps ensure mutual benefits that assist the country in reaching the targeted strategies in place to meet the UAE National Agenda 2021 requirements.

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**FEWA supplies six areas; Ajman, Ras Al Khaimah, Um Al Quwain, Fujairah, Dibba and Al Dhaid surroundings**

**Q2: In August 2015, the UAE deregulated fuel prices for consumers. Since then, petrol prices for consumers increased by about 25%. Are you foreseeing an increase in electricity and water rates for consumers in 2016?**

**H.E. Mohammed Mohammed Saleh:** The UAE relies on natural gas for around 99% of its needs in producing electricity and desalinating seawater. The deregulation of fuel prices will have no effect on utilities and consumers in the UAE, as diesel has been liberalised for a long time and a minimal share of holistic fuel is required, meaning that any change in fuel prices will not impact on FEWA's activities. Moreover, FEWA's tariff scheme is based on a number of elements and diesel is not part of the cost scheme.

**Q3: Could the deregulation of fuel prices for consumers be a suitable case study for the expected economic impact, behavioural changes and acceptance of the removal of subsidies on electricity and water prices in all Emirates?**

**H.E. Mohammed Mohammed Saleh:** The Ministry of Energy announced the deregulation of fuel prices in the UAE to support the rationalisation of fuel, protect the natural sources of energy and enhance economic sustainability. Behavioural change will occur alongside the deregulation decision, which will help and support the economy of the country.

In addition, behavioural change is encouraged through conservation campaigns. As a federal entity, FEWA launched a conservation campaign in 2013. Additionally, to help motivate the population and aid achievement of the goals behind this campaign, FEWA launched the Emirates Conservation Award (ECA). The ECA targets four different categories; schools, housewives, mosques and governmental entities. By targeting selected categories, FEWA is able to convey the message behind rationalisation to the public and ensure that every citizen is involved in this campaign.

FEWA is running a programme to eliminate subsidies and implement cost-reflective prices. FEWA has been proactive in this direction over the past three years and has managed to eliminate subsidies from the majority of consumer category.

## ABOUT **H.E. MOHAMMED MOHAMMED SALEH**



H.E. Mohammed Mohammed Saleh is the Director General of the Federal Electricity & Water Authority (FEWA) and has over 33 years of experience in the utilities sector.



[The] de-regulation of fuel prices will have no effect on utilities and consumers in the UAE (...) Rationalisation is a huge topic that everyone should be aware off since the UAE's consumption is double the rest of the world

**Q4: Dubai has been steering its energy sector through the Supreme Council of Energy since 2009 and in 2014, Abu Dhabi founded the Abu Dhabi Energy Agency. How are you involved in this?**

**H.E. Mohammed Mohammed Saleh:** FEWA is a federal entity that reports to the UAE Federal Cabinet and H.E. Suhail Mohammed Al Mazrouei, Minister of Energy Chairman, FEWA Board of Directors.

**Q5: With the breakthrough pricing Dubai Electricity and Water Authority (DEWA) received for solar power through a power purchase agreement, are similar models on the cards at a federal level?**

**H.E. Mohammed Mohammed Saleh:** FEWA has included more Public-Private Partnership (PPP) models into its strategic planning, especially for renewable energy, where including private partners will enable us to reduce upfront investment needs to reasonable prices.

**Q6: Which major developments will shape the UAE energy market in 2016?**

**H.E. Mohammed Mohammed Saleh:** In my opinion, there are a number of major developments that will shape the UAE energy market in 2016 and over the coming years, starting with Private Partnerships Agreements (PPA). Agreements under private partnerships should all be implemented with defined goals and objectives to ensure a coherent approach. Sustainability will be the main topic, which will be highlighted through different approaches within the energy market. This topic will cover how the UAE is highlighting this factor and the initiatives that utility authorities are considering to be able to meet the UAE's Vision 2021. Three main ideas should be further developed for 2016, which are:

- Smart cities
- Infrastructure developments
- Rationalisation of energy

Covering these three areas will be important, as each contributes to sustainability. Rationalisation is a huge topic that everyone should be aware of, as the UAE's consumption is double the rest of the world. Studying this topic will lead to the development of innovative ideas that will help reduce wastage of energy and cause major developments in the coming years. ■

# WHOLESALING ELECTRICITY IN THE UAE

## AN INTRODUCTION TO OPPORTUNITIES IN ELECTRICITY WHOLESALE

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The price of electricity reflects the factors driving the market, which are supply and demand

Electricity prices are a reflection of market drivers: supply and demand. Supply incorporates generation, transmission and distribution, which must be sufficient to meet simultaneous customer demand instantaneously and reliably. Consequently, key supply factors affecting prices include fuel prices, capital costs, transmission capacity and constraints, and the operating characteristics of power plants. Sharp changes in demand, as well as extremely high levels of demand, affect prices as well, especially if less efficient, more expensive power plants must be utilised to serve the load, affecting the price of electricity.



Electricity markets have retail and wholesale components. Retail markets involve the sale of electricity to consumers (both domestic and industrial), while wholesale markets typically involve the sale of electricity between electric utilities before it is sold on to consumers. This article focuses on wholesale markets.

Historically, Chile was the first country to introduce competition in the electricity sector in 1987. Not long after, England, Wales and other developed countries followed suit. In the United States, the Energy Policy Act of 1992 officially encouraged a transition to wholesale electricity competition. In Singapore, the government has been attempting to liberalise the electricity market through a series of processes since 1995. The main organisation which operates Singapore's wholesale energy market is the Energy Market Company (EMC), a branch of the Energy Market Authority (EMA).



UNITED ARAB EMIRATES  
MINISTRY OF ENERGY



ARTICLE

By  
**Eng. Abdullah Alshahyari**



#### ABOUT **ENG. ABDULLAH ALSAHYARI**



He is the Acting Director of the Conservation and Efficiency Department in Ministry of Energy. He also worked as Director of the Systems Control Center in the Electricity Sector of the Federal Electricity and Water Authority (FEWA).

## The Electricity Market in the United Arab Emirates

There is no effective and competitive electricity market in UAE, despite the fact that most of the required components have been established, one of them being transmission interconnection lines. Transmission interconnection lines connect utilities and allow for the exchange of power between utilities, facilitating trade. Major utilities generally own sufficient capacity to meet their own peak power needs, however, sometimes the cost of operating at marginal generation is higher or lower than that of their neighbours. Transmission availability provides opportunities for utilities to save money by buying energy when it is cheaper than generating and selling energy to utilities with higher costs. Some utilities in UAE are practicing this through the Emirates Transmission Network. The Federal Electricity and Water Authority (FEWA) is buying most of its energy needs from Abu Dhabi Water and Electricity Authority (ADWEA) for the reasons aforementioned and to offset limited generation capacity. Sharjah Electricity and Water Authority (SEWA) is also buying from ADWEA, for the same reasons. The Emirates Transmission Network provides an opportunity for further trade between utilities, especially those which have excess capacity and more efficient generation. Those utilities can sell power to others experiencing undersupply or with low efficiency in generation. Industrial generation can also be bought and sold through the transmission network. This allows access and efficient use of the surplus capacity of the UAE. In addition, it leads to the economic dispatch of power and minimises the cost of providing electricity.

It is also worth mentioning that the UAE is part of the Gulf Cooperation Council Interconnection Authority (GCCIA). The UAE electricity network has been connected to the GCCIA network since 20 April, 2011, through Abu Dhabi Transmission and Dispatch Company (TRANSCO) which is part of ADWEA. This connection provides another opportunity for UAE utilities to trade within the GCCIA network, where there is more efficient surplus capacity. In addition, connection with the GCCIA reduces the spinning reserve of the UAE network, which benefits UAE-based utilities.

Given this, it is clear that most of the basic components of a wholesale market are available in the UAE, however, gaps need to be identified and addressed. Currently, the most significant missing component, which is a barrier to a competitive wholesale market in UAE, is the regulatory environment. Any wholesale market has to be established within a technical, economic and legal framework. Activating a competitive wholesale market in the UAE provides an opportunity to reduce some of the heavy energy production costs and provides incentives for controlling construction and operating costs of both new and existing generation capacity. ■



Retail markets involve the sales of electricity to consumers, while wholesale markets typically involve the sale of electricity between electric utilities before it is sold on to consumers

# INDEPENDENT WATER AND POWER PRODUCERS (IWPPs)



ARTICLE

By Eng.  
Waleed Salman

When faced with rising increase in demand for power and water, utility providers make continuous and intensive efforts to enhance their generation capacity. The Government of Dubai and the Dubai Electricity and Water Authority (DEWA) have opened the doors to private sector participation in energy generation and water production by adopting the Independent Water & Power Project (IWPP) model that will in turn enhance Dubai's economy further.

IWPPs sell their capacity and output to the utilities, the single buyer, under long-term power and water purchase agreements (PWPAs). These PWPAs usually have a term of about 20 to 25 years from the commencement of the commercial operation date of the plants. Each IWPP in Dubai is required by law to be licensed by the Regulatory and Supervisory Bureau for Water and Electricity (RSB) to carry out electricity generation and water production.



## Power and Water Purchase Agreement or Power-Purchase Agreement (PWPAs/PPAs)

The tariff paid to IWPPs operating thermal plants under PWPAs or PPAs commonly comprises two main separate components, for electricity and water:

- Capacity payments covering the fixed costs of the plant, such as return on capital, depreciation and fixed operating and maintenance (O&M) costs), which are payable when the plant is available for production irrespective of whether and how much the plant produces.
- Energy or water output payments for variable O&M costs that are payable only for the electricity or water actually produced by the plant.



On the other hand, payments to IWPPs generating PV solar energy are normally expressed in a single tariff paid for all the energy fed by the IWPP into a solar PV plant. This differs from a thermal plant in it generates electricity continuously for as long as there is available sunlight.

## Process for Awarding PWPAs and PPAs

Generation and desalination projects may be developed by IWPPs on a build, own and operate (BOO) or on a build, own, operate and transfer (BOOT) basis. In both cases, PWPAs and PPAs are awarded after a competitive bidding process. For projects, the primary bidding criterion is the lowest levelised tariff for the sale of electricity and water. Utilities manage the entire bidding process through pre-qualification of bidders, issuance of requests for proposals (RFP) and selection of the successful bidder for the projects. The successful bidder can be a single company or a consortium of companies.

## Ownership structure

In the Emirate of Dubai, an IWPP project company is established as a joint stock company by the successful bidder or consortium. The bidder can also establish a local holding company through which it will own shares in the IWPP project company. Normally, 51% of the IWPP project company is owned by the utility or its local holding company and the remaining 49% of share capital of the IWPP is owned by the successful bidder.



The RFP issued by the utility for any IWPP contains a draft of the shareholder agreement to be entered into by the local holding company and the successful bidder to establish the IWPP project company and govern the relationship between the shareholders. The IWPP project company is governed by a Board of Directors appointed by the shareholders. Operational management of the IWPP is with the successful bidder.

## Financing

The project costs are funded through a combination of debt, equity and internally-generated net operating cash flows, if any, of the IWPP. The debt is arranged on a non-recourse project financing basis. The successful bidder is responsible for arranging the required financing and for negotiating financing agreements with the lenders. The debt may be raised in international, regional, Islamic or local debt or capital markets.



## DEWA's first IPP

The PPA for DEWA's first IPP is a 200MW photovoltaic plant in the second phase of the Mohammed bin Rashid Al Maktoum Solar Park, which will be operational by 2017. The PPA was signed on 26 March 2015, with successful financial closure on 8 July 2015.



The Solar Park will produce more than 3,000MW of electricity when completed in 2030 and supports the Dubai Integrated Energy Strategy 2030 developed by the Dubai Supreme Council of Energy to diversify Dubai's energy mix. Solar energy will account for 7% of the total energy production by 2020 and 15% by 2030. The project company Shuaa Energy 1 has formed as per UAE law with DEWA as a 51% stakeholder and the rest 49% by the bidder ACWA & TSK, DEWA will work closely with the project company to achieve the commercial operation date planned in April 2017.

The project, which occupies 4.5 square kilometres, will help to achieve a reduction of approximate 400,000 tonnes of carbon emissions by 2020. This supports the green initiatives and programmes implemented by the Government of Dubai to reduce carbon emissions. This IPP project will increase the capacity of solar energy projects in Dubai to 220MW.

Implemented in partnership with the private sector, the IPP project is a key step towards achieving the objectives of the Dubai Integrated Energy Strategy 2030, in which solar energy is set to become part of Dubai's energy portfolio with an increase in the share of renewable energy in the total mix.

A large number of international organisations were interested in this project. The wide participation in the bid reflects the trust and interest of international investors to invest in this vital field, which is supported by the Government of Dubai. DEWA will continue to execute these ground-breaking IPP projects in renewable energy and contribute to meeting the growing energy needs of Dubai. ■

### ABOUT ENG. WALEED SALMAN



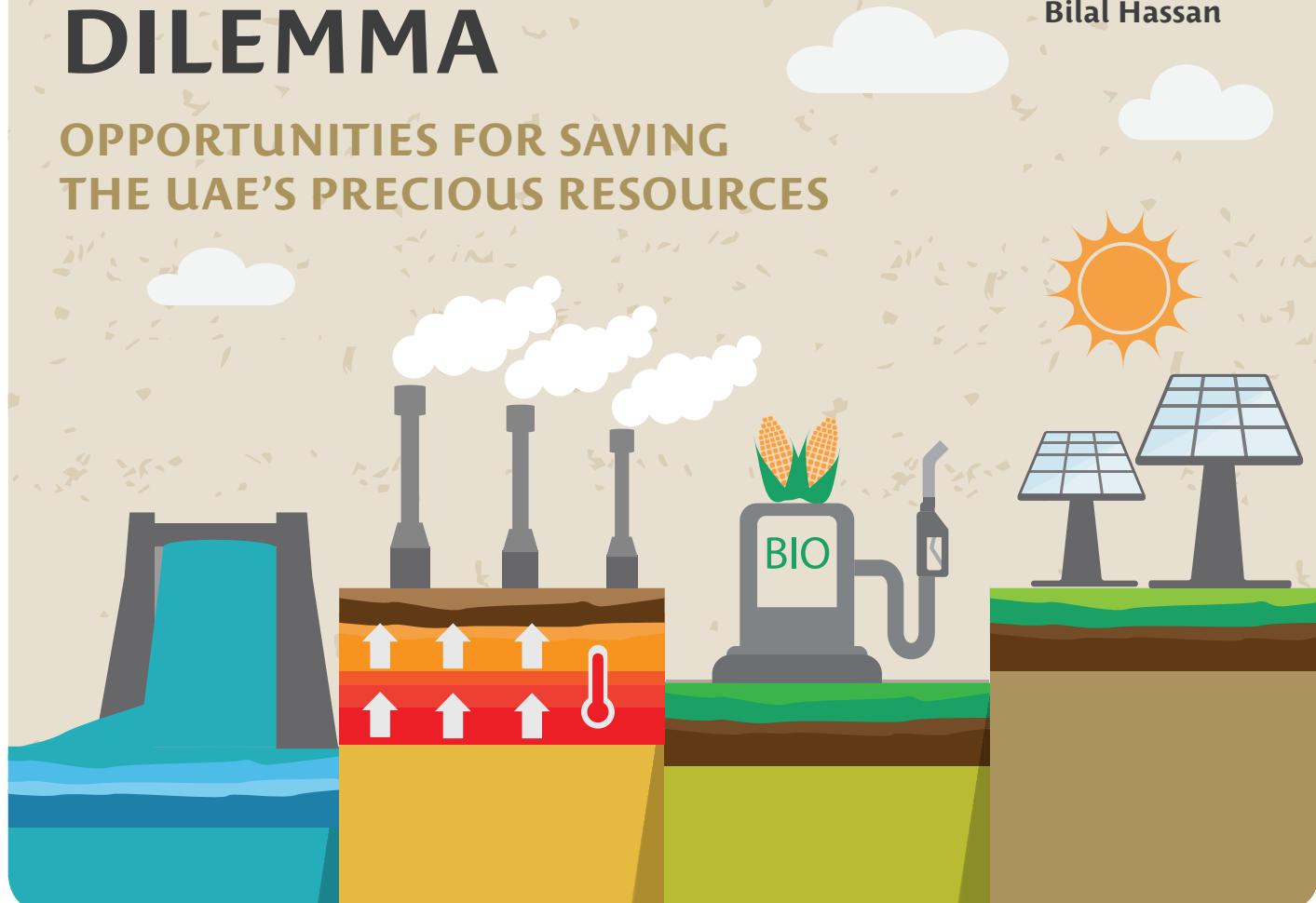
He is EVP Strategy and Business Development at Dubai Electricity and Water Authority. He is also in charge of Corporate Strategy and Business Development and oversees new business ventures in areas such as product diversification (e.g. Mai Dubai), energy efficiency (e.g. Etihad Energy) and low carbon development (e.g. Dubai Carbon). He is a leading figure in the Emirate's quest for green economic development through his involvement as a member of Dubai Supreme Council of Energy, the World Green Economy Summit, the Green Economy Partnership as well as internationally in the 'De-carbonise Energy' Global Agenda Council of the World Economic Forum.

# THE EASY WAY OUT OF THE ENERGY DILEMMA

## OPPORTUNITIES FOR SAVING THE UAE'S PRECIOUS RESOURCES



By Eng.  
Bilal Hassan



According to the Federal Electricity and Water Authority (FEWA), an average UAE resident consumes 25kWh of electricity and 550 litres of water per day, in comparison with the global average of 15kWh of electricity and 235 litres of water. Such high consumption trends are troubling numbers for the government, given that most of the UAE's power generation and water desalination is primarily natural gas-based, a fuel which is exceedingly scarce and costly to produce or import.

These numbers have been resonating within public and private circles, however, this article does not seek to remind readers about the alarming energy and environment dilemmas knocking on our door. Rather, it seeks to highlight one easy way out, which each one of us could subscribe to – that is on an individual level, we can maintain our current lifestyles with half the current power, fuel and water requirements per person per day.

How is this possible? A little investigation yields interesting results. The following is a list of selected measures that can be employed to save water, fuel and power at the individual level. This non-exhaustive list was developed using an approximate scenario with simple assumptions to convert qualitative demand-reduction measures into quantitative savings of water, power and fuel. It aims to raise awareness about the benefits of such measures to all UAE residents, while highlighting the cumulative benefits for the entire Nation and the environment. ♦



UNITED ARAB EMIRATES  
MINISTRY OF ENERGY

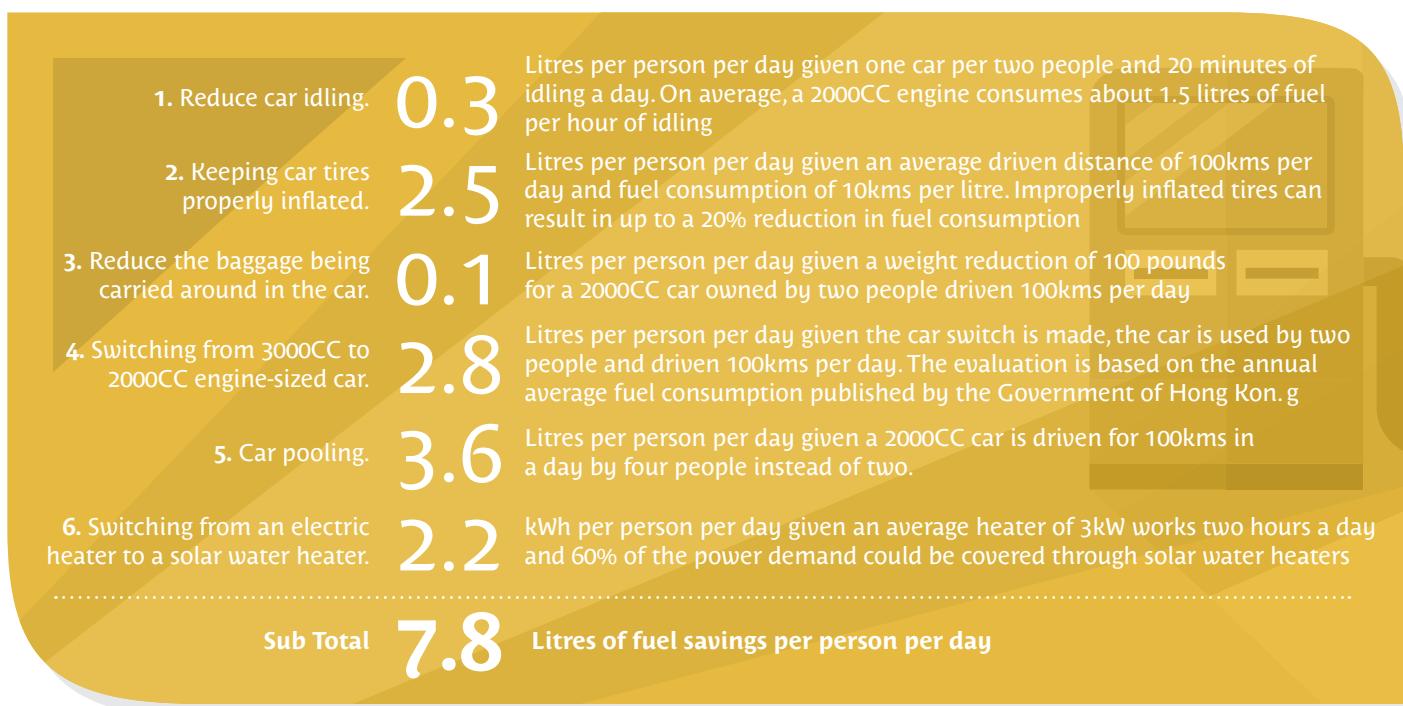
## Electricity Saving Measures

<b>1.</b> Switching from a top-loader laundry machine to a front-loader laundry machine	<b>0.1</b>	kWh per person per day given two loads per week. The power consumed by a top-loader machine is 0.3kWh per load on average and front-loaders have roughly 70% lower energy demand compared to top-loader machines
<b>2.</b> Not using an electric dryer and hanging clothes out in the open.	<b>0.9</b>	kWh per person per day given two loads per week and power consumption of 3kWh per load for drying
<b>3.</b> Replacing 10 incandescent bulbs with compact fluorescent lamps	<b>0.2</b>	kWh per person per day given 10 60W bulbs are replaced with 15W compact fluorescents in a house of two people with eight hours of lighting per day
<b>4.</b> Switching from a plasma (least efficient) to an LED (most efficient) television	<b>0.2</b>	kWh per person per day given three hours of TV watched every day by two people. A 42-inch LED consumes 80W in comparison to a plasma which consumes 300W.
<b>5.</b> Increasing air-conditioner thermostat setting by two degrees	<b>2.4</b>	kWh per person per day given 20 hours of central AC (2kW unit) usage for two people. Increasing temperature by one degree can result in up to 6% power saving on cooling during summer.
<b>6.</b> Switching from an electric heater to a solar water heater	<b>3.6</b>	kWh per person per day given an average heater of 3kW works two hours a day and 60% of the power demand could be covered through solar water heaters.
<b>Sub Total</b>	<b>7.3</b>	<b>kWh of power saving per person per day</b>

## Water Saving Measures

<b>1.</b> Install aerators on bathroom faucets, especially in old buildings.	<b>4.5</b>	Litres per person per day
<b>2.</b> Turn off water and plug the sink when brushing teeth and shaving.	<b>38.0</b>	Litres per person per day
<b>3.</b> Installing a high efficiency toilet (5 litres per flush rather than 20-30 litres per flush)	<b>71.9</b>	Litres per person per day
<b>4.</b> Washing only a full load of clothes rather than a half-load of clothes.	<b>32.4</b>	Litres per person per day given two laundry cycles per week
<b>5.</b> Take a five-minute shower rather than a 10-minute shower with a water-efficient shower head.	<b>94.6</b>	Litres per person per day given two showers a day
<b>6.</b> Installing an energy efficient dishwasher compared to an average one.	<b>3.2</b>	Litres per person per day given dishwasher is used twice a week for two people.
<b>7.</b> When washing your hands, turn off the water while you lather.	<b>13.5</b>	Litres per person per day given washing hands six times a day with an efficient water tap
<b>8.</b> Wash cars/boats with a bucket, sponge, and hose with a self-closing nozzle.	<b>35.2</b>	Litres per person per day given one car/boat for four people washed once a week within 20 minutes
<b>Sub Total</b>	<b>293.4</b>	<b>Litres of water savings per person per day</b>

## Fuel Saving Measures



## Cumulative Resource Savings

Current UAE population

**9,030,000**

Total Population



Considering approximately 25% of population is able to practice such power, water and fuel savings.

**2,257,500**

Reference population

Number of days in a year the saving measures are practiced

**330**

Reference days per year



**Total annual water saved**

**219**

Billion litres of water



**Total annual transport fuel saved**



**5**

Billion litres of fuel



**Total annual power saved**

**5,444**

Gwh of power

## ABOUT ENG. BILAL HASSAN



He graduated with a Masters in Mechanical Engineering from Masdar Institute and worked initially in the International Renewable Energy Agency (IRENA) as a Strategy and Research Analyst for the Country Support and Partnerships Unit. He recently joined the Ministry of Energy of UAE as a Clean Energy Expert and has initiated various projects in areas such as distributed solar; renewable energy mapping; national energy balance; federal energy strategy; and carbon capture and storage.



**An annual reduction of 20 million tonnes of CO<sub>2</sub> emissions paralleled with savings of AED 22 billion on expenditure, (...) could be diverted to health, education and job creation**

### Tabulated CO<sub>2</sub> Savings

CO<sub>2</sub> emissions avoided through water saved

**1.53**

In million tonnes based on 7kg of CO<sub>2</sub> emission savings per cubic metre of water (DEWA)

CO<sub>2</sub> emissions avoided through transport fuel saved

**14.54**

In million tonnes as per US Environment Protection Agency (EPA) methodology emission factor for petrol: 2.325kgs CO<sub>2</sub> per litre and diesel: 2.664kgs CO<sub>2</sub> per litre. For this analysis, we used an average figure of 2.5kgs of CO<sub>2</sub> per litre.

CO<sub>2</sub> emissions avoided through power saved

**3.81**

In million tonnes based on 0.7kg of CO<sub>2</sub> emission savings per kWh of power demand saving as per DEWA.

Total CO<sub>2</sub> emissions avoided

**19.88**

Total million tonnes of CO<sub>2</sub> saved

Groucho Marx, an American comedian, once said “Why should I care about posterity (future generations)? What has posterity ever done for me?”

An annual reduction of 20 million tonnes of CO<sub>2</sub> emissions paralleled with savings of AED 22 billion on expenditure, which could be diverted to health, education and job creation, demands an effort by all residents of the UAE. This complements the vision of our founding father, H.H. Sheikh Zayed Al Nahyan, who emphasised that development and progress in UAE should account for not only the current generation but all future generations. ■

### Tabulated Cost Savings

1. Annual cost of water savings

**2.19**

Billion AED, based on water production cost of 10AED per m<sup>3</sup>

2. Annual cost of fuel savings

**17.44**

Billion AED, given production cost of gasoline is 3 AED per litre

3. Annual cost of power savings

**2.07**

Billion AED, given the production cost of power to the utilities is 0.38 AED per kWh

Total annual savings

**21.70**

Billion AED



# DEWA SIGNS POWER PURCHASE AGREEMENT AND SHAREHOLDER AGREEMENT FOR SECOND-PHASE 200MW PV PLANT AT MOHAMMED BIN RASHID AL MARTOUM SOLAR PARK



Dubai Electricity and Water Authority (DEWA) has signed a Power Purchase Agreement (PPA) and a Shareholder Agreement for the second phase of the Mohammed bin Rashid Al Maktoum Solar Park with ACWA Power- and TSK-led consortium to produce 200MW from photovoltaic solar power. This supports the directives of H.H. Sheikh Khalifa bin Zayed Al Nahyan, President of the UAE, to produce renewable energy locally, sustainably manage natural resources and support growth of a new promising sector, and the Green Economy for Sustainable Development initiative launched by H.H. Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, to make the UAE one of the global leaders of sustainability and a hub for the export and re-export of green products and technologies.

ACWA Power will finance, build and operate the 200MW photovoltaic plant at the Mohammed bin Rashid Al Maktoum Solar Park and will receive a 25-year PPA starting in 2017. This plant also sets a worldwide milestone for utility-scale solar power generation with a landmark tariff of USD 5.4 cents/kWh.

One of the largest strategic new Independent Power Producer (IPP) projects in the renewable energy market worldwide, the Mohammed bin Rashid Al Maktoum Solar Park will strengthen the position of Dubai as a global hub for trade, finance, tourism, sustainability, and green economy and an international role model for achieving the highest standards in energy efficiency.

The second phase is based on the Independent Power Producer model and will be operational by April 2017. The project, which occupies 4.5 square kilometres, will help to reduce the emission of 400,000 tonnes of carbon emissions, which supports the green initiatives and programmes implemented by the Government of Dubai to reduce carbon emissions.

Signing the first agreement based on the Independent Power Producer model supports the Dubai Plan 2021 to create a happy society that meets the needs of the citizens and residents of the Emirate.

The PPA agreement also supports the Dubai Integrated Energy Strategy 2030 developed by the Dubai Supreme Council of Energy to diversify Dubai's energy mix. Accordingly, solar energy will account for 7% of the total energy production by 2020 and 15% by 2030. Further expansion will see the Solar Park generating 3,000MW of electricity when completed in 2030.

Dubai has a clear strategy to diversify its energy mix using renewable energy with specifically solar, playing a key role. When combined with the availability of low-cost finance, solar PV technology becomes commercially cost-effective.

The Mohammed bin Rashid Al Maktoum Solar Park thus demonstrates Dubai's commitment of delivering reliable and sustainable electricity at the lowest kWh tariff. ■

### ABOUT ENG. WALEED SALMAN



He is EVP Strategy and Business Development at Dubai Electricity and Water Authority. He is also in charge of Corporate Strategy and Business Development and oversees new business ventures in areas such as product diversification (e.g. Mai Dubai), energy efficiency (e.g. Etihad Energy) and low carbon development (e.g. Dubai Carbon). He is a leading figure in the Emirate's quest for green economic development through his involvement as a member of Dubai Supreme Council of Energy, the World Green Economy Summit, the Green Economy Partnership as well as internationally in the 'De-carbonise Energy' Global Agenda Council of the World Economic Forum.



ARTICLE

By Eng.  
Waleed Salman

هيئة كهرباء ومياه دبي  
Dubai Electricity & Water Authority





INTERVIEW



# A MEETING WITH THE UAE'S ENERGY AND CLIMATE CHANGE ATTACHÉS

A new diplomatic programme promotes and advances the UAE's efforts in the field of energy and climate change

In 2013, the Ministry of Foreign Affairs launched an Energy Attaché programme, within the Directorate of Energy and Climate Change. The main aim of the programme was to promote and advance the UAE's significant efforts and achievements in the field of energy and climate change. The pilot programme currently involves three energy attachés to embassies in Berlin, Tokyo and Beijing – each of these countries having significant diplomatic importance for the UAE. Through their role, the attachés aim to:

- enhance communication, cooperation and policy alignment between the UAE and governments in select countries on the topics of energy and climate change;
- initiate and foster connections between energy businesses in the UAE and their international counterparts; and
- ensure that energy and climate change considerations are reflected in UAE engagement with the selected countries and that information on these countries' government policies and energy markets is accurate.

In the following section, we hear from each Attaché regarding their main achievements and how the role has helped to advance the UAE's interests abroad.

## MEET SHAIMA AL HABSI, UAE Energy and Climate Change Attaché – Germany

### ABOUT SHAIMA AL HABSI



Before her current role as an Energy and Climate Change Attaché at the UAE Embassy to Germany she worked in Abu Dhabi Future Energy Company (Masdar) as a senior analyst, running investment analysis for renewable energy projects; mainly Shams 1, one of the biggest CSP power plant in the region. She also worked for more than 7 years in the banking sector in several departments, but mainly treasury. She completed her MBA in 2013 at Strathclyde Business School in Scotland and has a Bachelor's degree in Mass Communication and Public Relations.

### Q1: Tell us about your background and how you came to take the role of Energy Attaché?

**Shaima Al Habsi:** The vision of the late H.H. Sheikh Zayed bin Sultan Al Nahyan to preserve the environment and diversify energy resources inspired me to transition from the banking sector into the area of energy and climate change. This led me to join the Abu Dhabi Future Energy company (Masdar), where I worked closely on the development of renewable energy projects – most notably Shams One, which is one of the largest CSP plants in the world. Exposure to such projects filled me with great enthusiasm to advance in this sector, as well as to promote my country's achievements in the area – and ultimately inspired me to apply for this post.

### Q2: What have been your main achievements since taking the post in Berlin?

**Shaima Al Habsi:** Upon commencing my post in Berlin, one of my main goals was to raise awareness about the new Attaché pilot project. To do this, I put forward a comprehensive outreach plan which targeted representatives from both the German government and the private sector and shared with them the UAE's achievements in the energy and climate change sector, as well as to emphasise the legacy planted by the late H.H. Sheikh Zayed and carried on by H.H. Sheikh Khalifa Al Nahyan. In addition, I have participated and presented in numerous national events and conferences, which I used as opportunities to highlight the UAE's achievements and efforts to date.

Furthermore, in light of the UAE Vision 2021, which calls for growth to be “fuelled by a sustainable range of energy sources”, I saw the need for transferring knowledge of the German energy transition “Energiewende”, in terms of policy and technology, to the UAE. I therefore was involved in organising a series of workshops between the UAE and the German government in January 2015, during Abu Dhabi Sustainability Week (ADSW). The workshops were inaugurated by H.E. Suhail Al Mazrouei, UAE Minister of Energy, and co-hosted by DECC and the German Ministry for Economic Affairs and Energy. One of the main outcomes was a decision by the UAE and German governments to enter an MoU, through which they will explore cooperation in the energy field. A second workshop is being planned in Berlin.



I put forward a comprehensive outreach plan which targeted representatives from both the German government and the private sector, and shared with them UAE's achievements in the energy and climate change sector

### Q3: How has the Energy Attaché role helped evolve UAE-Germany relations, in climate change and energy, as well as more broadly?

**Shaima Al Habsi:** The Energy and Climate Change Attaché role in Germany has a particular importance, due to the UNFCCC events which take place in Bonn and the effective role of the UAE in such meetings. Supporting the UAE delegations in these meetings and participating in other relevant meetings is one of my main priorities. Supporting the UAE's relations and engagement with the IRENA Innovation and Technology Center (IITC) office in Bonn is also an important function of the role.

More broadly, the Energy Attaché role has been a critical function in acting as a link between UAE entities and their German counterparts. An example of this is the recent reception that was hosted by the embassy, to promote the Zayed Future Energy Prize and encourage submissions. The event was attended by high-level government and non-government officials.

The importance of the Energy Attaché role in Germany was further recognised this year, when I was chosen, among representatives from 12 out of 70 interviewed embassies, to participate in the German International Diplomatic Program. The programme acts as a further platform through which I participate in different events and meet with entities to raise awareness of the UAE's achievements and provide further links between our countries.

## MEET OMRAN RASHID TARYAM,

**Energy and Climate Change Attaché – Japan**

### ABOUT OMRAN RASHID TARYAM



He is an Energy and Climate Change Attaché at the UAE Embassy to Japan. He earned his Bachelor's degree in Economics from Queen Mary, University of London and his Master's Degree in Environmental Economics from Hosei University in Tokyo.

### Q1: Tell us about your background and how you came to take the role of the Energy Attaché?

"On land and in the sea, our fore-fathers lived and survived in this environment. They were able to do so because they recognised the need to conserve it, to take from it only what they needed to live, and to preserve it for succeeding generations." There were many reasons why I started to study about energy and the climate, but I think the vision of the late Sheikh Zayed and his desire to protect the UAE's environment was the deciding factor for me as an economist. UAE initiatives like Masdar and IRENA convinced me that the UAE would be in need of experts in the field and as a student preparing my Master's thesis in Tokyo, I felt that there is a lot we can learn from the Japanese and their experiences. Japan is the world's third-largest economy and a long-time trading partner with the UAE but there were only a few UAE students in Japan. Given my love of Japanese culture and language, I felt that I could be most useful in helping bridge the gap between the UAE and Japan in the field of energy and climate change.

### Q2: What have been your main achievements since taking the post in Tokyo?

I feel that by far my most prominent achievement has been to raise awareness of all the energy and climate-change related achievements that the UAE has accomplished in the past few years. This was possible mainly through presenting the UAE's key milestones in the sector at seminars and workshops. Moreover, as I am aware of the UAE's needs in sustainable development, I always ensure that the UAE's priorities are being addressed when arranging visits to Japan for many entities from the UAE. This has enabled the Japanese to understand the needs of the UAE and facilitated many exchanges, through which our two countries can share knowledge, technology and know-how. As an example, the official visit of H.H. Sheikh Mohammed Bin Zayed Al Nahyan to Japan in 2014 paved the way for many MoU's and agreements in the sector, including a nuclear agreement and two MoU's in sustainable development, one with Masdar and the other with ADNOC.

### Q3: How has the Energy Attaché role helped evolve UAE-Japan relations in climate change and energy, as well as more broadly?

When the Department of Energy and Climate Change started looking for potential attachés to send abroad, a background in energy and climate change and good interpersonal skills were key requirements. However, the most important requirement is the ability to communicate in the language of the host country. Many Japanese entities would like to start business relationships with the UAE, but are hesitant due to the language barrier and/or the lack of a UAE expert in the field at their disposal. The Energy Attaché helps overcome this challenge. For example, I can provide Japanese companies with key contacts in the UAE to help them invest or start a project in the field of energy and climate change. Moreover, having gained the trust of many contacts in Japan, I can help UAE entities find the right partners to overcome any challenges they may face. Sending a Japanese-speaking diplomat to the UAE embassy in Tokyo as an Energy and Climate Change Attaché sends a strong message that the UAE values its energy relationship with Japan and seeks to cooperate in tackling the climate-change challenge as an important and responsible member of the international community.



**Japan is the world 3rd largest economy and a long time trading partner with the UAE but there were only a few UAE students in Japan**

# LET'S **SAVE** **THE WORLD** TOGETHER



“

The main aim of the Attaché Programme was to promote and advance the UAE's significant efforts and achievements in the field of energy and climate change

# MEET ENG. MAITHA AL KAABI,

Energy and Climate Change Attaché – China

## ABOUT ENG. MAITHA AL KAABI



She joined the UAE Embassy in China as a Climate Change Attaché in 2013. She has a Master's degree in Water and Environmental Engineering from Masdar Institute of Science and Technology, where she often served as a representative of the Institute in media appearances, presenting at energy and climate-change conferences and summits and hosting VIP dignitaries. In addition to her knowledge of water systems, she has deep lab expertise in chemical and materials characterisation techniques. While at Masdar Institute, she participated in the development of two innovations that were later filed for patents; inventing better pharmaceutical tablets and developing biodegradable nano-composites.

## Tell us about how you came to take the role of Energy Attaché?

My love for the UAE drove me to where I am today. The UAE is blessed with hydrocarbons, which have enabled its rapid modernisation; but with limited fresh groundwater, our booming economy is dependent on the world's second-highest production of desalinated water. As our nation's leaders often stress, in the UAE, water is more important than oil.

With the hope of supporting the UAE's effort to enhance water security, after completing my studies in Chemistry at UAE University, I went on to pursue a Master's of Science in Water and Environmental Engineering from Masdar Institute of Science and Technology. During my studies, I gained expertise in water systems and participated in the development of two innovations that were later filed for patents.

As the first laboratory-oriented Emirati at Masdar Institute, I often served as a representative of the Institute in media appearances, presenting at energy and climate-change conferences and summits and hosting VIP dignitaries. I began to see how important diplomacy and awareness are in effecting positive change on water and environmental issues. When I learned that the Department of Energy and Climate Change (DECC) was creating an Energy Attaché post in China, I saw huge potential in expanding the already strong UAE-China trade relationship to the areas of energy and water, and jumped at the opportunity.

## What have been your main achievements since taking the post in China?

I agree with my fellow Energy Attachés; the most significant achievement has been to raise awareness. In addition to presenting the UAE's growing environmental achievements at dozens of conferences, summits and embassy events, the work I have done with student/education outreach has been extremely important. This includes growing awareness here in China, giving presentations at schools and establishing and strengthening relations with educational organisations, many of which influence education in China at the national level. It also includes growing awareness back home in the UAE. For example, as I'm writing this, I'm working on an interesting assignment in collaboration with the Crown Prince Court in hosting a contingent of UAE university students for a couple of weeks, exposing them to China's major industrial players, including those in energy. Building the UAE-China relationship within our educational institutions extends to the coming generation and will benefit both our nations for years to come.

## How has the Energy Attaché role helped evolve UAE-China relations in climate change and energy, as well as more broadly?

The Energy Attaché role has enabled the UAE Embassy in Beijing to create new relationships and build upon existing relationships in order to create a strong network, specifically within climate change and energy. A great example of the power of this network came when the embassy recently received a request from the Zayed Future Energy Prize (ZFEP) in the UAE to help them increase their exposure in China. We reached out to our network and within a couple of weeks, we had more than five major organisations commit to disseminate information on the ZFEP, providing them access to tens of thousands, or more likely, hundreds of thousands of relevant readers. ■



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# INNOVATION IN THE ENERGY SECTOR



COMMENTARY

By Eng. Hind  
Almutawwa



Innovation is seen as a process of matching technical possibilities to market opportunities, involving multiple interactions and types of learning

**Why innovation? Is it a new management style? Is it a new trend in business excellence that will fade over time? Is it not adequate for the government and private sector to continue enhancing the processes by which work is done?**

Innovation in all sectors is a necessity in the UAE. This article explains the primary determinants and importance of innovation within the energy sector.

The UAE, similar to other GCC countries, has a unique socio-economic profile and a number of environmental and natural-resource challenges. This creates the need for a customised and collaborative environment to pave the way for technology innovation in the energy sector.

The challenge of water scarcity requires approaches and technologies that go beyond the status quo. What is necessary are innovative solutions tailored to the context of the UAE. Dust, humidity and high temperatures are the primary challenges in the installation of solar cells in the region, something not experienced by the countries developing most solar technologies. Innovation is therefore required to enable the UAE to fulfill its vision of a green future. The Ministry of Energy considers innovation to be a key priority to achieve the goals in Vision 2021 and beyond.

**What characterises innovation in the energy sector in a complex world trying to secure energy supply while limiting negative environmental impact and supporting prosperous societies?**

Globally, countries vary in their ability to provide prosperity to their citizens, which often relies on how productively a country uses available resources. The Global Competitiveness Report by the World Economic Forum looks at 144 economies on the basis of 12 broad pillars, one of which is innovation. Countries that rank high on the competitiveness scale, such as Switzerland and the USA, are those that rely on innovation.



UNITED ARAB EMIRATES  
MINISTRY OF ENERGY

The UAE Vision 2021 highlights the strong bond between innovation and a competitive economy across seven main sectors. The transformation to a knowledge-based economy will bring about the desired changes and cooperation between the government, universities and industry is a successful model for completing the cycle of innovation in the macroeconomic portfolio. The UAE has witnessed increasing energy intensity over the last decade, considerably above the global average. Rapid economic growth implies growing energy demand and the UAE relies heavily on conventional hydrocarbon-based energy generation. With the current subsidised energy prices, tariffs have not reflected the real cost of energy generation, although this is set to change as subsidies are reduced. Renewable energy and energy-efficiency solutions therefore represent a door to be opened.

Another factor has been the high cost of renewable investment, however, with the current drop in the cost of photovoltaic installations, it is now feasible for the UAE to increase the share of renewables in the energy mix. On the demand side, it is important to encourage investment in energy efficiency. While private companies may regard the capital costs of investing in energy efficiency prohibitive, the payback periods can be short and the returns substantial.

**The country is the pioneer in the region in terms of competitiveness and innovation**

Technological innovation in the energy industry is not a choice, it is an imperative. History shows how innovation in other industries, such as IT and agriculture, can cause dramatic shifts in productivity, guiding societies onto new pathways. Looking at the prices of oil, gas, steel, copper, and aluminum, it is clear that energy innovation is vital for all energy carriers, not simply electricity. These markets are poised for a swift change, allowing for the absorption of innovation from other sectors.

According to Chris Freeman and Luc Soete "innovation is seen as a process of matching technical possibilities to market opportunities, involving multiple interactions and types of learning". This is evident when we look at developments such as shale oil and shale gas, enhanced oil recovery, electric cars, district cooling and heating, and mass transit facilities relying on innovative fuel sources.

The spread of innovative technologies can help countries sustain economic growth, with reduced impact on the environment. Accelerating innovation and technology adoption is crucial for meeting climate-change mitigation goals.

The history of innovation in other sectors, such as agriculture, chemicals, semiconductors, information technology and biopharmaceuticals, shows the complex role that public and private sectors have played in triggering innovation and sustaining it, once it is in motion. Best practices around the world demonstrate how the integration of the government and private sectors and academic research institutions can result in successful innovation. With the strength of the three sectors; government as a policy-enabler, academic institutes as research and development providers; and the private sector as the product developer, innovation can be realised.

**ABOUT  
ENG. HIND ALMUTAWWA**



She is the Director of Regulation and Supervision Department & CEO of Innovation at the Ministry of Energy. She has a project management experience in power generation, control, transmission & distribution. She has MSC in Engineering System Management & BSc in Electrical & Electronics Engineering both degrees from the American University of Sharjah. She is also Winner of Distinguished Employee in Sharjah Government Award 2006, Leadership Program Graduate 2008. Currently joining Innovation Diploma with MBR Centre of Innovation in collaboration with Cambridge University.

Although the above-mentioned fields differ from the energy sector, there are commonalities with energy-sector innovation. One such commonality is the importance of the protection of intellectual property rights and knowledge creation, diffusion and exploitation. Setting a policy framework for innovation is a critical concern.

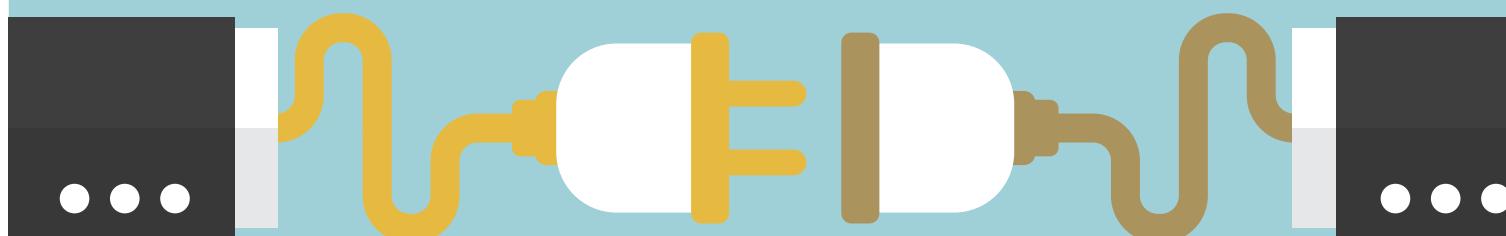
In summary, the UAE vision regarding diversity of the energy mix, with less dependency on hydrocarbons, opens the door for innovation. A free market is essential to urge competitiveness and spur innovation. The UAE is the pioneer in the region in terms of competitiveness and innovation and a well-formulated innovation strategy recognises the important roles played by the public and private sectors, as well as research institutions. ■



**Transforming the economy to be based on "knowledge" will bring about the desired changes**

# HOW DOLPHIN ENERGY MEETS 30% OF THE UAE'S ENERGY REQUIREMENTS EVERY SINGLE DAY

THE UAE'S RAPIDLY GROWING ECONOMY IS DEPENDENT ON GAS AS THE HYDROCARBON WITH THE LOWEST GRID-EMISSION FACTOR



By Adel Ahmed  
Albuainain



730 billion standard cubic feet has been delivered every year since 2009

“

No accidents, no harm to people and no damage to the social and natural environment

In September 2014, Dolphin Energy's Dolphin Gas Project achieved a major milestone when it passed five trillion standard cubic feet of cumulative production since operations began in July 2007. 730 billion standard cubic feet has been delivered every year since 2009, helping support the UAE's industrial growth and economic development and ensuring natural gas remains at the heart of the country's energy mix.

We have a unique and critical role to play in meeting 30% of the UAE's energy requirements every single day. This represents a huge challenge that wouldn't be possible without four important factors. They are firstly, a robust HSE&S programme, secondly, a comprehensive maintenance and monitoring programme, thirdly, a strong partner relationship and finally, the support of our shareholders. In addition, QP's supplies of diverted LNG have helped meet high customer demand during the peak summer months'.

### A Robust HSE&S Programme

From the outset of the Dolphin Gas Project our goals have been simply stated: "No accidents, no harm to people and no damage to the social and natural environment". Ensuring the highest levels of health and safety of our employees, the communities in which we operate and of all our assets is the single most important objective. Without this commitment, we simply would not, could not, operate.

Our HSE division develops standards, strategies and plans in line with international best practice while all our actions are monitored and reviewed in the interests of continuous improvement. Management systems drive our approach to occupational and process safety and without these parameters, we could not have achieved the lowest ever Total Recordable Incident Rate (TRIR) since operations began or were recorded, with more than seven years without any Lost Time Injury (LTI).

Incentives also play an enormous role in maintaining the highest standards possible, which is why we recognise and reward the efforts of our employees and contractors when we can. HSE Champions Awards are given every year, while the Annual Contractors Meeting honours their commitments while serving as a platform to learn from issues and shared experiences.

Together, all these elements have helped create a strong HSE culture which in turn supports our ability to ensure reliable, safe and secure supplies of natural gas to the UAE.

### A Comprehensive Maintenance and Monitoring Programme

Integral to our commitments to process safety is a comprehensive maintenance programme which we implement every year. Maintenance programmes are standard industry practice and help ensure we maintain plant availability and reliability at all times. They also provide an important reminder of the need to ensure we operate safely and securely and complement the array of monitoring systems we have in place, from well-integrity and pipeline-integrity management programmes to comprehensive pipeline network patrolling and surveillance systems.

Without a planned maintenance programme – which requires the coordination and cooperation of our customers – we would not be able to enjoy the high levels of availability and reliability of natural gas supplies to the UAE. This is the fifth year in a row that we have secured 100% plant availability and our approach to maintenance – both preventive and predictive – is a large contributor to that success. ☺

### A Strong Partner Relationship

There are, of course, external factors that ensure we maintain our commitments to meet the UAE's energy requirements, none more so than the relationship we enjoy with our strategic partner, Qatar Petroleum (QP). QP has shown wonderful levels of support and cooperation, which have been of real benefit to our customers in the Emirates. In addition to taking two billion scf per day of natural gas from Qatar, QP provides additional volumes on an interruptible basis – on average up to 125 million scf per day – when there are opportunities to do so. In addition, QP's supplies of diverted LNG have helped meet high customer demand during the peak summer months. This has also aided in reducing the UAE's carbon footprint because it means alternative fuels, like diesel, are not used.

### Shareholder Support

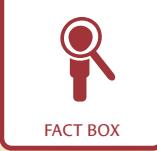
Finally, we could not be as successful in our commitments without the support of our shareholders, Mubadala Development Company, Total and Occidental Petroleum. Their guidance, expertise and insights have been central to our success and have helped us maintain our commitment to ensuring UAE energy security. They share our vision so that when our customer requirements change, we are able to respond quickly and appropriately.

This has allowed us to deliver volumes of natural gas more effectively and efficiently. We have seen this in the development and expansion of our downstream pipeline network by adding the Al Ain to Fujairah and the Taweeleah to Fujairah pipelines to the Eastern Gas Distribution System. It has meant that we have been able to supply all seven emirates of the UAE with a source of energy required for power generation and water desalination. It has also meant that we can use more than one route to ensure volumes reach the eastern coast of the Emirates to support the needs of Fujairah and the local communities.

In addition, the support provided by our shareholders to invest in an upgrade at our plant at Ras Laffan, which has seen the installation of three new export gas compressors, shows our shareholders believe in what we're seeking to achieve.



**This is the fifth year in a row that we have secured 100% plant availability and our approach to maintenance – both preventive and predictive**



### WHAT'S THE UAE'S EMISSION FACTOR?

According to the Greenhouse Gas Protocol (GHG Protocol), the UAE's electricity emission factor in 2009 was 0.6312 – the second lowest among the six Gulf Cooperation Council (GCC) countries after Qatar (in order: Qatar, United Arab Emirates, Bahrain, Saudi Arabia, Oman and Kuwait). All six GCC countries average 0.7099. The World Economic Forum furthermore ranks the UAE first in being able to deliver secure, affordable and sustainable electricity among the six GCC countries.

### ABOUT ADEL AHMED ALBUAINAIN



He is the Chief Executive Officer at Dolphin Energy Limited. He is responsible for the direction of the company and its activities in the UAE and Qatar. Prior to his current position, Mr. Albuainain was the company's General Manager in Qatar since 2007. With more than 36 years experience in the oil and gas industry, he also served as Vice President for Projects and Site Support at Abu Dhabi Polymers Company (Borouge), having been seconded from ADNOC.



#### Sources:

GHG Protocol (Emission Factors from Cross-Sector Tools):  
<http://www.ghgprotocol.org/calculation-tools/all-tools>;

World Economic Forum: <http://www.weforum.org/news/124-countries-ranked-ability-deliver-secure-affordable-and-sustainable-energy>

## An Economic Backbone

The Dolphin Gas Project is a unique energy initiative and a shining example of what can be achieved with a strong vision and the unerring will to succeed. We have enjoyed many successes, but we also recognise that maintaining current commitments takes hard work and dedication.

It is well-known that the demand for natural gas in the UAE is increasing. Many projects are in various stages of development that will raise domestic gas production to help meet some of that demand. We will continue to play our part by ensuring we stay focused and maintain reliable, safe and secure volumes to support the country's growth and prosperity. In turn, this will allow the UAE to minimise the use of carbon-heavy alternative fuels for power generation which are costlier and have a detrimental impact on the environment. ■



**In addition to taking 2 billion scf per day of natural gas from Qatar, QP provides additional volumes on an interruptible basis – on average up to 125 million scf per day**



# All the angles covered

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# ENERGY & THE CONSUMER

HIS EXCELLENCY  
SHEIKH ABDULLA BIN BATI AL HAMED  
CHAIRMAN, ADWEA



As the level of economic activity continues to increase across the Emirate, total consumption and peak demand for both water and electricity in Abu Dhabi are expected to continue increasing at the current rate of about 8% per annum until 2020. Demand for electricity and water is relatively high in Abu Dhabi, where power consumption increased from 49.3TWh in 2013 to 52.8TWh in 2014 and water consumption increased from 1195 to 1250 million cubic metres during the same period. This may be attributed to:

- 1) Rising population and economic activity
- 2) Limited awareness among consumers
- 3) The high governmental levels of subsidy
- 4) Limited efficiency standards and policies in place which could drive improved efficiency
- 5) The harsh climate in summer leading to:
  - high levels of energy consumption for cooling
  - excess capital expenditure
  - sub-optimal asset utilisation at low demand times

Recognising these challenges and aiming to reduce consumption and promote greater efficiency and sustainability, Abu Dhabi Water & Electricity Authority (ADWEA) and its stakeholders undertook the following initiatives;

- In 2012, ADWEA introduced a new billing format designed to advise consumers on whether their bill is high or low relative to others occupying similar accommodation
- Implementation of a smart meter reading project to calculate energy consumption for various customers and monitor load profiles
- Implementation of a water leakage pilot by ADWEA and ADC to identify sources and locations of leakages within the Al Ain network to mitigate water loss
- Implementation of a chiller control pilot by ADWEA and the RSB to study the impact of load controls applied to chillers in five large buildings in Abu Dhabi
- Implementation of a home makeover pilot by ADWEA and the RSB to study the impact of a range of efficiency measures applied to 10 villas in Abu Dhabi that had high levels of consumption

ADWEA is striving to achieve greater environmental sustainability and enhance the previously developed strategy for demand-side management based on:

- Customer engagement programmes to rationalise consumption
- Establishing and encouraging energy efficiency and sustainability via various programmes
- Economic incentives like tariff changes to provide customers with financial incentives to alter demand patterns leading to a reduction in consumption

# END-USE EFFICIENCY OF ELECTRICITY AND WATER IN ABU DHABI



MAIN REPORT

By H.E.  
Saif Saeed Al Qubaisi

## Demand growth in Abu Dhabi

The sustained economic and population growth of the Emirate of Abu Dhabi has been a major contributor to the growth of potable water and electricity demand. In 2014, the Emirate's demand for electricity was almost 9GW, while the peak water supply reached 763MIGD. Such substantial growth places increasing challenges on the sector to meet demand, while maintaining reliability and security of supply.

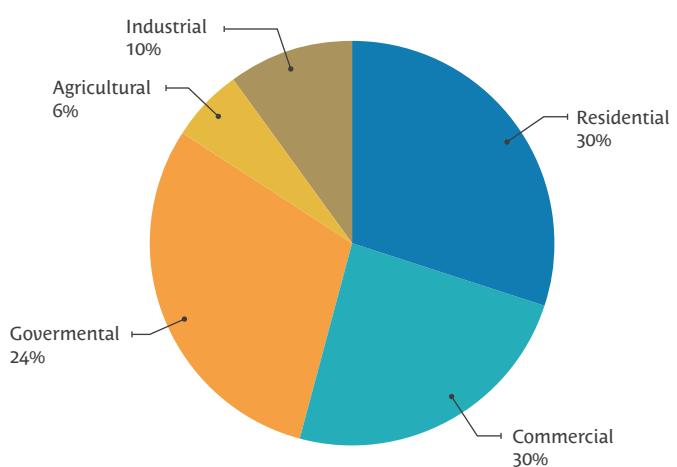
Abu Dhabi relies heavily on air conditioning to maintain the levels of comfort a modern society expects, particularly as summer temperatures can reach up to 50 degrees Celsius. Humidity is also high throughout the year, but particularly during summer. It is estimated that air conditioning is responsible for more than 60% of peak electricity demand in summer.

## Electricity and water consumption in Abu Dhabi

As the residential, commercial and government segments contribute to more than 80% of electricity consumption in the Emirate of Abu Dhabi, it is crucial to target these segments when developing demand-side management (DSM) initiatives. The industrial segment currently consumes around 8%, however, Abu Dhabi's vision for economic diversification over the coming years means an expected increase in power consumption share for this segment.

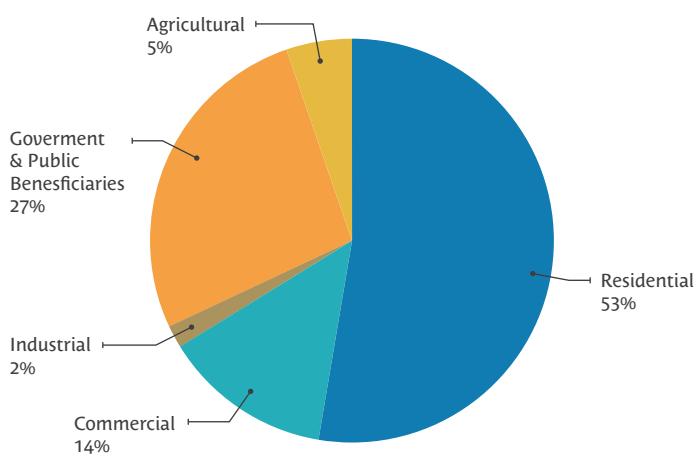
Similarly, the majority of water consumption in Abu Dhabi is attributed to the residential, governmental and commercial segments, representing 90% of the Emirate's overall water consumption.

**Fig. 1:** Electricity consumption by consumer segment – Emirate of Abu Dhabi



Source: ADDC/AADC Annual Information Submission

**Fig. 2:** Water consumption by consumer segment – Emirate of Abu Dhabi



Source: ADDC/AADC Annual Information Submission



## Abu Dhabi's energy mix

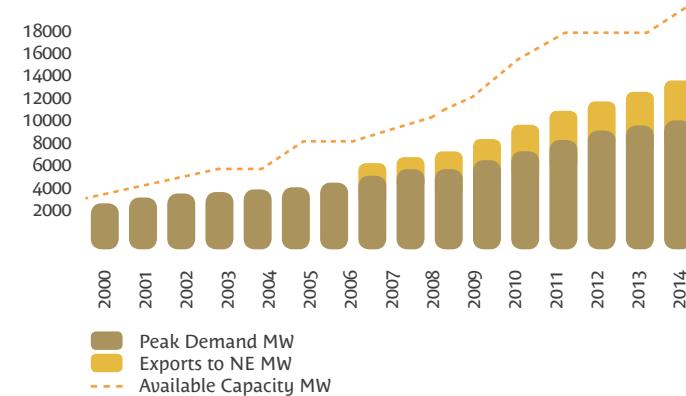
Currently, the majority of Abu Dhabi's electricity is generated from natural gas. To reduce reliance on fossil fuel, Abu Dhabi has been investing in renewable energy sources such as solar. Furthermore, by way of diversification of energy sources, the Emirate is building nuclear power plants at Barakah, 240 kilometres west of the City of Abu Dhabi. The first reactor, with a capacity of 1.4GW is expected to be commissioned in 2017, while three more reactors are to be completed in 2018, 2019 and 2020 for a total capacity of 5.6GW by 2020.

## Electricity and Water Demand Growth

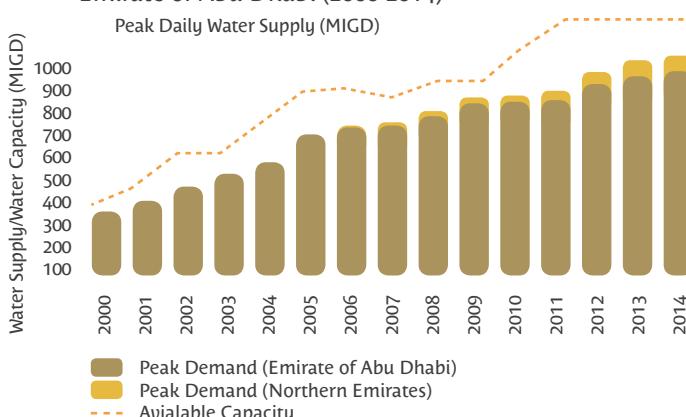
The demand for water and electricity has been growing in the Emirate of Abu Dhabi to support economic and population growth. A yearly average increase in peak demand of 8% has been observed over the past 10 years.

Electricity peak demand has almost doubled over the last 10 years, placing tremendous pressure on the electricity grid. Figure 3 shows the growth in electricity peak demand between 2000 and 2014 and Figure 4 shows the growth in water peak demand between 2000 and 2014. Maintaining secure and efficient supply during peak periods is an increasing challenge, however, with a world-class electricity infrastructure, the Abu Dhabi Emirate has risen to the challenge year-on-year. In this context, demand-side management has become an increasingly crucial tool to manage the ever-increasing growth in electricity and water demand

**Fig.3:** Electricity demand growth -  
Emirate of Abu Dhabi (2000-2014)



**Fig.4:** Water demand growth -  
Emirate of Abu Dhabi (2000-2014)



Source: ADWEC, Forecast Submission 2015





## Overview of Abu Dhabi's Initiatives

Table I lists some of the main initiatives being carried out in Abu Dhabi in respect to demand-side management for both water and electricity.

**Table I:** Summary Of Abu Dhabi Emirate Initiatives

Organisation	Activity/Study
Executive Affairs Authority (EAA)	Comprehensive Cooling Plan (CCP)
Abu Dhabi Municipality (ADM)	Demand-Side Energy Management Programme in Existing Buildings
Abu Dhabi Distribution Company and Al Ain Distribution Company	DSM strategy and action plan, and conservation campaigns
Environment Agency – Abu Dhabi	Plumbing code, water budget and coordinating awareness activities
Urban Planning Council	Estidama Programme
Emirates Authority for Standardization & Metrology (ESMA)	Emirates Energy (and Water) Star Labelling*
Department of Municipal Affairs (DMA)	Abu Dhabi International Building and Energy Conservation Codes
Abu Dhabi Education Council & Environment Agency Abu Dhabi	Sustainable school design
Quality and Conformity Council	Environmental performance Trustmark
Regulation & Supervision Bureau	Powerwise and Waterwise offices

\* Federal initiative

These initiatives cover broad, yet complementary, areas of energy and water efficiency aspects in the Emirate, ranging from consumer-focused campaigns to projects looking into the new-build environment. While setting new building codes with a view to achieve electricity efficiency in new buildings, it is also important to consider existing building stock and work on practical and business-case driven interventions, ranging from building retrofits to implementing demand-side management technologies such as direct load management.

**For the current price control period, PC5, following consultation with licensees, the Bureau has offered incentives for end-use efficiency or DSM**

## Regulatory framework and incentives

At the last price control review conducted by the Bureau in the Emirate (PC4 2010-2013), a DSM indicator was introduced. Its purpose was to provide an incentive for distribution companies to encourage residential consumers to reduce water and electricity consumption. The price control review currently being undertaken (PC5 2014-2017) is assessing how the effectiveness of these arrangements can best be improved. For instance, price controls could provide more funding for DSM initiatives and consumer information campaigns. Such arrangements would require careful monitoring and regulation to ensure resources are effectively used.

For the current price control period, PC5, following consultation with licensees, the Bureau has offered incentives for end-use efficiency or DSM.

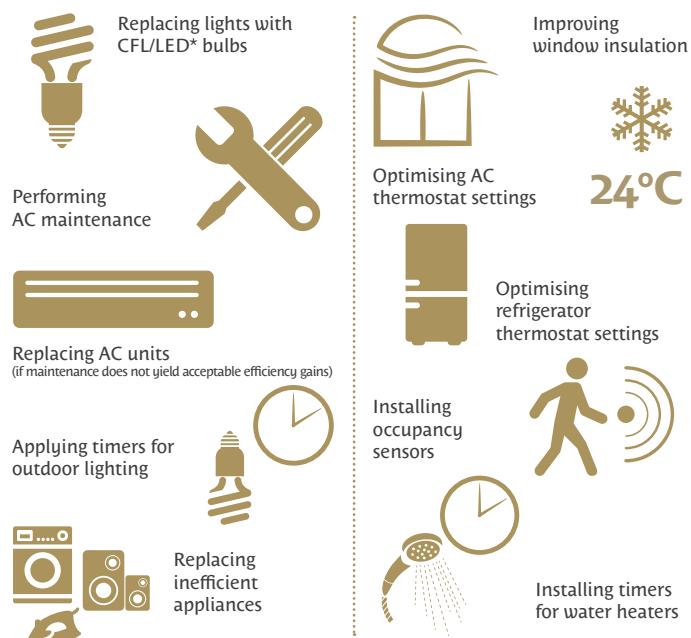
## Success stories

### Powerwise Home Makeover

Powerwise, an initiative of the Regulation and Supervision Bureau launched in January 2013, aims to raise awareness and promote best practices in electricity conservation in Abu Dhabi. In 2015, Powerwise completed its Home Makeover project which aimed to investigate and measure the energy savings achieved through home efficiency upgrades in a sample of residential households. Powerwise selected 10 Abu Dhabi villas with high electricity consumption and conducted detailed home energy audits for each before providing energy-efficiency upgrades for the villas and studying the impact on electricity consumption.

The implemented actions consisted of a series of Energy Conservation Measures (ECMs) across a number of areas, such as air conditioning, lighting and envelope and control systems.

**Fig.5: Summary of the applied Energy Conservation Measures**



\*CFL: compact fluorescent lamp, LED: light-emitting diode

The Powerwise Home Makeover demonstrated a 25% average saving in 10 residential households in Abu Dhabi with a payback of less than 3 years.



#### Waterwise Residential End-Use of Water Project

In Abu Dhabi, the residential sector consumes a significant amount of the desalinated water produced for the Emirate. Water consumption can vary significantly depending on the type of property, therefore developing an in-depth understanding of water consumption in the residential sector has been a key focal point for the Bureau's Waterwise initiative.

In 2014, Waterwise completed the Residential End-Use of Water Project, in which detailed statistics on water consumption from medium-sized villas were studied in unprecedented detail. The end-use of water was studied across 150 villas, through installing smart meters and using flow-trace analysis software. The project provided a detailed breakdown of water end-uses in the study homes.

Continuing on the path of building baseline data on water consumption in the residential sector, Waterwise commenced an In-Home Water Use Audit in 2015. This project aims to collect additional information on water consumption in larger and older homes as compared to the properties studied in the Residential End-Use of Water Project and also includes villas in Al Ain. The objective of this project is to investigate the causes of high water consumption in the residential sector and help residents use water wisely.

The studies carried out by Powerwise and Waterwise are providing vital information that can inform planning and forecasting, as well as drive electricity and water conservation initiatives. ■

#### ABOUT H.E. SAIF SAEED AL QUBAISI



H.E. is the Acting Director General, Regulation and Supervision Bureau. He has extensive experience as a leader in the water and electricity sector in the UAE and has a proven track record in project management and sustained service delivery. Before joining the Bureau, he held the position of Energy Affairs Director of the Executive Council. Over the past 10 years, he has worked for various entities including the Abu Dhabi Water and Electricity Authority (ADWEA), ALDAR Properties and Abu Dhabi Transmission and Despatch Company (TRANSCO).

# THE SHAMS DUBAI INITIATIVE

**Harnessing a small fraction of the sun's solar radiation could satisfy all of the world's energy demand. Solar energy is a great source of renewable clean energy with available, proven technologies (the most common uses solar photovoltaic cells) to convert this energy into electricity to power our daily needs.**



By Eng.  
Waleed Salman



Dubai has a twofold strategy to use solar energy. One is DEWA's developing a large-scale solar generation at the Mohammed bin Rashid Al Maktoum Solar Park, as well as the Shams Dubai Initiative.

Under the Smart Dubai initiative announced by H.H. Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, to make Dubai the smartest city in the world, the Executive Council Resolution number 46 of 2014, was issued by H.H. Sheikh Hamdan bin Mohammed bin Rashid Al Maktoum, Crown Prince of Dubai and Chairman of the Dubai Executive Council, to regulate the connection of distributed solar powered systems to Dubai's electricity grid.

With this resolution, DEWA has set the initial steps to harness the power of the sun and enabled future connections of distributed solar powered systems in the Emirate of Dubai. This resolution was the foundation for the framework developed to encourage DEWA's customers to install solar PV panels to generate their own renewable energy -generated electricity and connect them to DEWA's network.

## How it works

With the issuance of the resolution and as part of its implementation, DEWA launched in March 2015 the Shams Dubai Initiative, also known as the Distributed Renewable Resources Generation (DRRG) programme. The Shams Dubai initiative is based on a net metering scheme that allows customers to generate electricity from solar PV panels and export any unused electricity to DEWA's network. This electricity can be recovered by the customer at no cost from the grid when the sun is not shining, or in general, where the premises that the system is installed requires more power than what is generated by the solar system.

All materials explaining the connection process and supporting documents and guidelines are available in one dedicated portal that can be used as a one-stop gateway for all customers, consultants and contractors, and equipment manufacturers. Each stakeholder has a dedicated area explaining the requirements and procedures associated with the initiative for easy reference, with the objective of helping customers have their solar PV systems successfully installed and connected to DEWA's network in a relatively short period of time, ensuring the safety and reliability of the connected systems and DEWA's network.

## How customers can install a solar PV system

As the first step, customers should contact one of the DEWA-enrolled electrical or DRRG solar PV consultants. They will be the main point of contact between the customer and DEWA. Only those who are enrolled with DEWA as Electrical and DRRG Solar PV Consultants and Contractors will be allowed to apply for solar PV connections for their customers. A list of all enrolled consultants and contractors is available on the Shams Dubai portal.

Once a consultant or contractor has been selected, it will be responsible for the design and execution works of the installation, as well as dealing with the relevant authorities for the application process

After the system is installed and connected, all the electricity generated will benefit customers by reducing their monthly bill. Any electricity produced that is not consumed by them will be credited to their account and may be consumed at a later stage.

Through the Shams Dubai initiative, DEWA is showing its commitment to harnessing the power of the sun and enabling interested customers in Dubai the connection of distributed solar powered systems.

Now is the time for anyone interested in solar energy to participate in Shams Dubai and contribute to the vision of H.H. Sheikh Mohammed bin Rashid Al Maktoum, for a smart sustainable future for Dubai. ■

## ABOUT ENG. WALEED SALMAN



He is EVP Strategy and Business Development at Dubai Electricity and Water Authority. He is also in charge of Corporate Strategy and Business Development and oversees new business ventures in areas such as product diversification (e.g. Mai Dubai), energy efficiency (e.g. Etihad Energy) and low carbon development (e.g. Dubai Carbon). He is a leading figure in the Emirate's quest for green economic development through his involvement as a member of Dubai Supreme Council of Energy, the World Green Economy Summit, the Green Economy Partnership as well as internationally in the 'De-carbonise Energy' Global Agenda Council of the World Economic Forum.



More information is available on DEWA's Shams Dubai website ([www.dewa.gov.ae/shamsdubai](http://www.dewa.gov.ae/shamsdubai))



Now is the time for anyone interested in solar energy to participate in Shams Dubai and contribute to the vision of H.H. Sheikh Mohammed bin Rashid Al Maktoum, for a smart sustainable future for Dubai

# TECHNICAL GUIDELINES FOR THE NON-TECHNICAL



**THE NEW GUIDELINE  
FOR EXISTING BUILDING  
OWNERS, OPERATORS,  
AND END-USERS TO  
INCREASE OPERATIONAL  
EFFICIENCY**



ARTICLE

By  
Tara Tariq

In June 2015, Emirates Green Building Council (EGBC) launched its first edition of the Technical Guidelines for Retrofitting Existing Buildings. Thanks to its member pool of experts, EmiratesGBC has been serving as a sounding board for the sustainable building industry in the UAE, echoing the consensus among major government and market entities on the importance of increased energy efficiency of the existing building stock; or inversely, the importance of decreased wastage within buildings with regards to energy and water consumption.

**The Technical Guidelines are a response to this vocal and legislative momentum and serve to influence a positive alteration of current energy consumption rates in the country.**

## Why Energy Efficiency Matters

The topic of energy efficiency has been a recurring one in industry forums for the past few years. For anyone professionally or strategically involved in the design and construction industry, whether in the policy-making realm, or via the hands-on design, construction and refurbishment sphere, the repeated call to improve efficiency is testimony to the fact that sustainable development is not just a global hot topic, but rather, a national call for resourcefulness.

Carbon emissions comprise approximately 74% of the UAE's ecological footprint, according to data and analyses published by the World Wildlife Fund (WWF), and are a result of energy generation and emissions brought about by the burning of fossil fuels and the operation of inefficient buildings. In 2014, the WWF estimated the UAE as having the third-highest ecological footprint in the world. In the same year, a study that was issued by the United Nations Environment Programme's (UNEP) Sustainable Buildings and Climate Initiative (SBCI) estimated that existing buildings account for nearly 40% of the world's greenhouse-gas output. In that category, operational stage energy use constitutes 80% of the gross energy used during the total life cycle of a building, while the embodied energy (energy used during raw material extraction and construction) accounts for only 15-20% of the total share. Hence, the importance of the operational energy efficiency of a building cannot be overstated as, in the UAE in particular, 80% of the energy produced is consumed by existing building.<sup>1</sup>

## Local Policy Response

The UAE's Agenda 2021 was introduced in 2014 and presented a seven-year roadmap, with specific mandates for sustainable development. The Agenda has called for improvements in air quality, clean energy and green growth plans. Implementation of these goals is strongly supported by local sustainability focused strategies, such as the Dubai Integrated Energy Strategy (DIES 2030) and Abu Dhabi Vision 2030. In Dubai, for instance, a key objective of the DIES 2030 is a 30% reduction in energy by 2030. As a result, in 2013 the Dubai Electricity and Water Authority (DEWA) and the Dubai Supreme Council of Energy (DSCE) formed the first and now well-established government-facilitated energy service company, Etihad ESCO. Further regulatory support provided by the Dubai Regulatory and Supervisory Bureau (RSB) ensures the government leads by example with robust retrofit projects in its existing buildings and creates market and financial confidence among stakeholders in the private sector.

In Dubai, for instance, a key objective of DIES 2030 is a 30% reduction in energy by 2030



**UNEP's Sustainable Buildings and Climate Initiative (SBCI) estimated that existing buildings account for nearly 40% of the world's greenhouse-gas output**

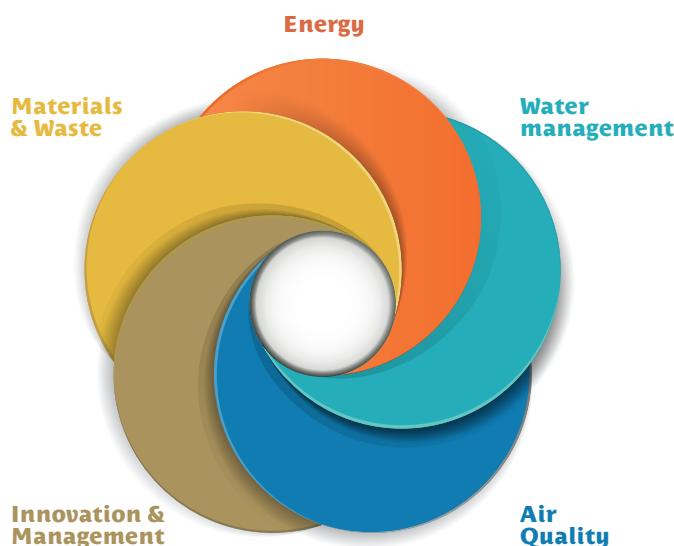
## The Technical Guidelines

The EmiratesGBC Technical Guidelines have been developed in conformance with all of the above policies and objectives and provide a comprehensive set of instructions, best practices and theoretical guidance on how existing building owners, operators and end-users can make informed decisions that can potentially increase the operational efficiency of their buildings. Chapters related to energy usage, water management, air quality, waste handling and innovative team management serve to inspire and catalyse change through building retrofits that can benefit not only the surrounding environment, but also the short and long-term bottom line.

## The Content

A retrofit process involves several processes that are inter-related and interactive. While the Technical Guidelines split them into specific categories, strategic implementation is left to the reader's discretion based on building typology, usage parameters and financial capacity. The retrofit measures nevertheless complement each other and form a synergistic whole – in other words, the more methods implemented the more sustainability, efficiency and cost-saving merits a building can accrue.

The Technical Guidelines recommend 31 key topics and retrofit activities that are grouped into five chapters:



Each chapter provides relevant guidance on preconditions, methodology, action plans, cost-benefit analyses and illustrative case studies, educating readers on specific retrofit methods on every topic.

The chapter contents bring awareness to potential immediate and long-term reductions and efficiencies and go beyond the more popular efficiency dialogue of energy and water to also address other building aspects that serve astute building owners, operators and end-users, who can appreciate the benefits of taking a holistic retrofit approach. References at the end of each subchapter point to the best resources for further in-depth study and fact verification.



**The technical guidelines recommend 31 key topics and retrofit activities that are grouped into five chapters: energy, water management, air quality, materials and waste, and innovation and management**

### Chapter One Energy 1

Energy management in buildings is a vast and well-established field which utilises various systems and technologies.

This chapter highlights the main ways energy consumption can be optimised in existing buildings from simple no-cost/low-cost solutions and building shell improvements to fully integrated Energy Management Systems (EMS) which can bring significant long-term savings within a short period of time.

### Chapter Three Air Quality 3

When retrofitting a building, IAQ is a critical aspect of the project to take into consideration, as most people spend a significant amount of their time indoors.

Strategies to improve indoor air quality that are covered in this chapter include specifying materials with low VOC and chemical concentrations and better monitoring and testing of ventilation equipment.

The potential to reduce liability for building owners, increase the resale value of buildings and improve the health of occupants is an expected benefit for these kinds of retrofits.

### Chapter Five Innovation and Management 5

Innovative strategies that improve the liveability and sustainability of a building are constantly improving within the industry.

Training sessions provided to facility management staff on sustainable practices have proved to improve maintenance and caretaking schedules, subsequently increasing the life of a building and ensuring that efficient methods established in previous chapters are effectively implemented.

### Chapter Two Water Management 2

The Ministry of Environment and Water estimates that at current rates of consumption, the demand for potable water will double to 8.8 billion cubic metres by 2030.

This chapter walks through the various methods that facilitate the reduction in water demand, including by implementing proper water management techniques and by refurbishing and recycling water from various sources.

### Chapter Four Materials and Waste 4

It is estimated that more than 26 million tonnes of waste was collected in the UAE in 2012. Managing waste successfully is more than a legislative process. The responsibility for protecting the environment and people from the toxic fumes released from landfills and reducing unnecessary consumption of materials ultimately comes down to individuals who must develop and maintain their own effective strategies to control the production of waste.



1| The WWF Living Planet Report: Globally, overconsumption is rising and biodiversity is declining, but it is not too late - See more at: <http://goo.gl/8FW89S>

## The Intended Audience

The aforementioned building owners, operators and end-users roughly translate into FM professionals, building owners, officer managers, building managers, tenants and other end-users, all of whom are addressed specifically when applicable. The content in the Technical Guidelines has also been formatted to demonstrate retrofit solutions applicable to a large variety of building typologies, including offices, hotels, residences, schools and healthcare facilities.

A building owner who is new to energy efficiency will find that the Technical Guidelines provide a comprehensive primer on the topic, with supplementary methods that ensure post-retrofit maintenance and a continuation in cost savings. A facility manager who has already optimised existing operations will find suitable energy retrofit tips to further enhance building performance. In addition, the following audiences can also potentially benefit from the Technical Guidelines:

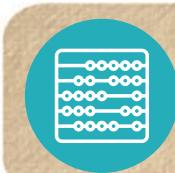
-  Financial institutions can obtain objective analysis of the savings and performance risks associated with specific retrofit projects.
-  Government agencies can determine the feasibility of regulations and financial incentives for energy-efficiency retrofit projects and specific retrofit principles.
-  Architects, design engineers and consultants participating in major retrofit projects can understand the larger scope of the work in which they are involved.
-  Individuals with no advanced technical background can identify solutions they will be able to implement without the need for extensive financial investments.
-  Graduates and post-graduates can use the guidelines for course supplementation and to gain reference sources for research, sustainability and engineering applications in academia.

Table 1: Technical Guidelines chapter brief.

## ABOUT TARA TARIQ



She is a Technical Officer at the Emirates Green Building Council. In addition to serving as Lead Editor for the Technical Guidelines, she is also the Lead for the EmiratesGBC's Energy Efficiency Programme.



## A Guide for Positive Change

The EmiratesGBC Technical Guidelines are succinct and focused for practical readability. For non-technical building stakeholders, this publication serves as an important educational component that bridges the gaps between policy, theory and implementation.

If successfully implemented, building retrofits have far-reaching implications that, in addition to addressing current international and local energy-reduction goals, can also reduce the financial burden on property owners and tenants as well as the existential burden on the planet. ■

# TOO COOL TO WASTE

## ENERGY EFFICIENCY THROUGH COMPREHENSIVE COOLING RESEARCH

**The United Arab Emirates has one of the highest ecological footprints per capita in the world<sup>1</sup>. In addition to the environmental consequences of unrestrained energy consumption, the fact that energy prices are subsidised in most Emirates results in a significant financial burden for the government. Furthermore, since peak demand determines the capacity of the supply/transmission/distribution systems, any reduction in peak load will be significant in terms of minimisation of investments in future asset expansion and optimisation of the existing infrastructure.**

Policy-makers and energy-sector planners are seeking ways to better utilise electricity infrastructure by reducing or shifting peak load and conserving energy. Demand-Side Management (DSM) measures ranging from advanced building controls to indoor climate control and building equipment/envelope enhancement are designed to address this problem. Accurate determination of the impact of such measures is a recognised barrier to the wider deployment of DSM initiatives. The task is complicated by the dynamic nature of the system, the coupled interaction of multiple sub-systems and the high correlation with weather and other perturbations.

As about 60% of the annual electricity consumption of the UAE and 75% of the peak demand can be traced back to air conditioning, a Comprehensive Cooling Plan (CCP) was initiated by the Executive Affairs Authority of Abu Dhabi to explore ways of improving the energy efficiency of buildings and building cooling systems. In that context, Professor Afshin Afshari and Professor Peter Armstrong of Masdar Institute were commissioned in November 2012 to execute several research projects over a two-year period in order to develop and validate cost-effective methods and tools aiming at reducing Abu Dhabi's air-conditioning load by 30%.



ARTICLE

By  
**Afshin Ashari**



**The projects involve a team of about 15 graduate students and research staff. They have three specific tasks:**

- Develop decision support methods and tools for city-wide demand-side management programmes;
- Monitor and analyse the performance of building air-conditioning equipment (remote diagnostics);
- Design and validate air-conditioning equipment optimised for GCC conditions based on Minimum Energy Performance Standard (MEPS).

Deliverables have consisted of reports and software tools enabling the large-scale implementation of proposed interventions. Assuming that all cost-effective measures – i.e., measures having positive Net Present Value (NPV) with the cost-reflective electricity price – identified in each of the above-mentioned tasks are implemented, the impact on the air-conditioning load can be estimated as follows:

ABOUT  
PROF. AFSHIN  
ASHARI



He is a Professor of Practice at the Masdar Institute of Science and Technology. He has 25 years of experience in Demand-Side Management (DSM). His current research interests include urban energy modelling, load forecasting, remote building diagnostics and decision support tools for DSM.



**about 60% of the annual electricity consumption and 75% of the peak demand of the UAE can be traced back to air conditioning**

**TASK 1:**  
23% savings achieved by implementing NPV-positive levers excluding the trivial thermostat reset measure;

**TASK 2:**  
20% savings achievable by implementing cost-effective air-conditioning remote monitoring and diagnostics systems;

**TASK 3:**  
The best performing NPV-positive chiller design represents savings of 19% in comparison to the baseline chiller.

Naturally, these savings are not cumulative. Taking account of dependencies among some of the measures, the total pre/post-retrofit air-conditioning energy savings resulting from consecutive implementation of the proposed interventions would, nonetheless, exceed 30%, thereby fulfilling the stated objective of the CCP initiative.

Application of task 1 outcomes is being discussed with Abu Dhabi Distribution Company (ADDC). Validation of task 2 outcomes is being conducted based on CCP's 1000-building survey data. Discussions are underway with a major chiller manufacturer and the Abu Dhabi Quality and Conformity Council (QCC) for the validation of task 3 outcomes. Transfer of the knowledge acquired in the course of the research projects is intended for supporting Energy Services Companies (ESCOs), air-conditioning manufacturers and government entities in charge of DSM. ■



1| WWF, Ecological Footprint Initiative,  
<http://bit.ly/1JmiAFt>

# RETROFITTING UAE'S BUILDINGS

## THE MINISTRY OF ENERGY INTRODUCES THE ENERGY CONSERVATION OF FEDERAL GOVERNMENTAL BUILDINGS

As nations throughout the world grapple with high energy costs, retrofitting buildings is gaining prominence as a way to reduce energy demand.

This is particularly relevant for the UAE. Although energy costs here are relatively low compared to other countries, the country's building sector consumes large amounts of energy. Almost 60% of the total UAE energy consumption is from the building sector<sup>1</sup>. In terms of the amount of energy needed per square metre of space, local buildings require large amounts of energy. One reason for this is the high need for cooling, which is predetermined by the country's harsh desert climate, however, inefficient building design and oversized, old or ill-maintained electrical equipment also play a role. ▶



Improvements in air-conditioning systems, lighting and insulation will be among the measures targeted in the retrofit programme



UNITED ARAB EMIRATES  
MINISTRY OF ENERGY

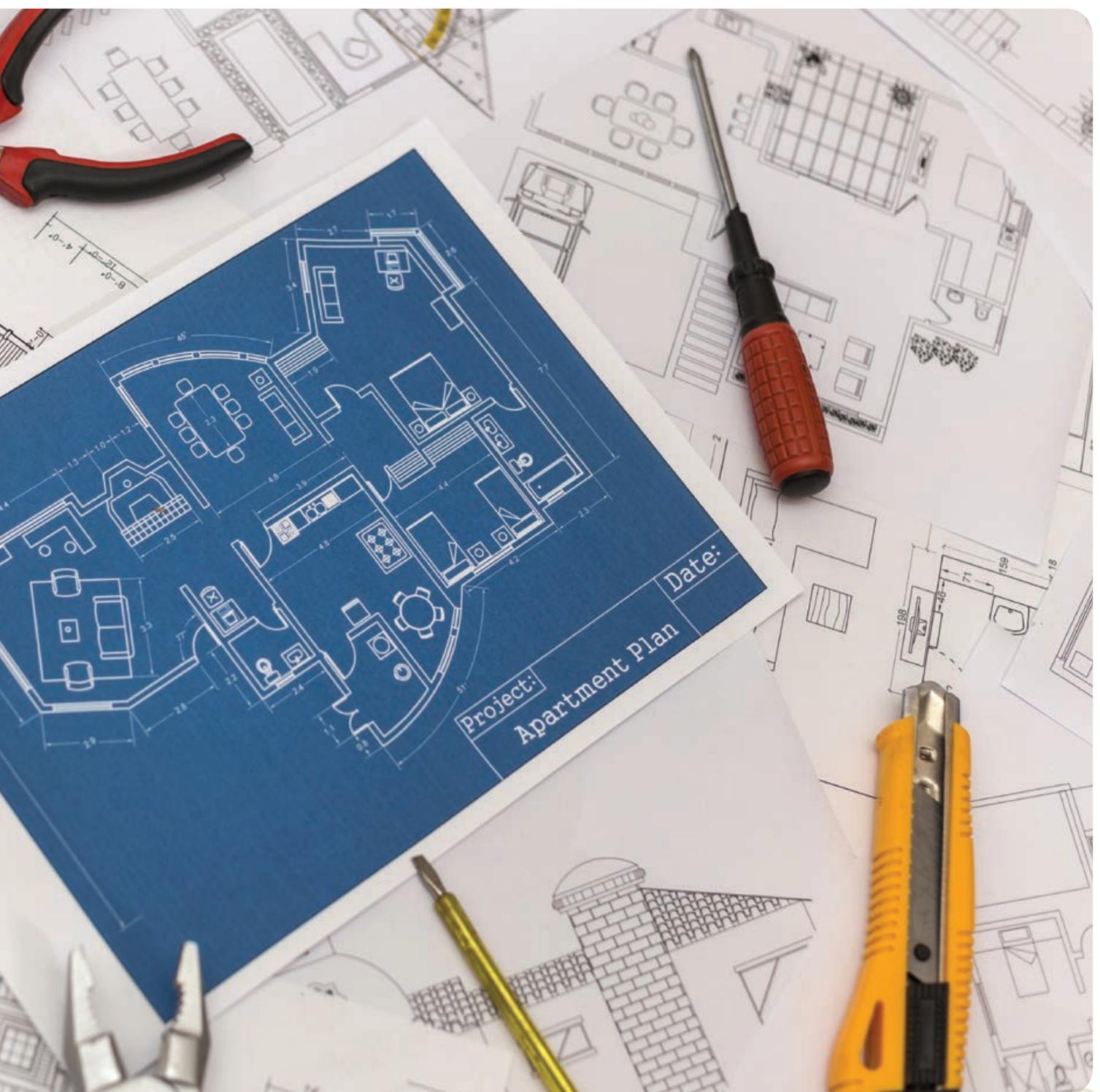


ARTICLE

By Eng. Somayyah  
Al Yammahi

“

Since the introduction of a slab tariff programme by the Dubai Electricity and Water Authority back in 2008, retrofit programmes started making economic sense for many users



Experts have estimated that, in Dubai alone, 30,000 of the 120,000 existing buildings can accommodate retrofit programmes, generating substantial savings. Efforts are already underway, especially in Dubai, to launch many retrofitting projects.

The Ministry of Energy is taking several steps, which it hopes will help multiply these successes, encouraging retrofit projects and programmes throughout the country. A new project has been established: Energy Conservation of Federal Governmental Buildings. In line with UAE Vision 2021 and the UAE Green Growth Strategy, the project will target retrofits in government buildings such as schools, hospitals, office buildings and others.

The retrofits will be implemented by a specialised company or companies which will manage energy consumption through various techniques. For this project, the model of energy contracting is the most suitable as it creates incentives to install new equipment and maintain it so that optimal performance is achieved. Energy-management system companies, in most cases, are simply managing existing equipment with little regard for energy savings. Improvements in air-conditioning systems, lighting and insulation will be among the measures targeted in the retrofit programme.

As a standard practice, retrofit programmes start with an energy audit, which establishes benchmark levels of energy and water consumption and also identify opportunities for savings.

As mentioned above, a number of initiatives are already taking place in Dubai. The Emirate has been leading the way in this field, as it has the highest

technical expertise. It is also important to mention that energy pricing has been creating incentives for building owners. Since the introduction of a slab tariff programme by the Dubai Electricity and Water Authority in 2008, retrofit programmes have started making economic sense for many users.

In 2013, DEWA established Etihad ESCO, which initiated a number of retrofit pilots but also laid the foundation for an energy performance contracting business sector to develop. One factor that could help the sector grow faster is support from banks in funding retrofit projects.

In June this year, the Emirates Green Building Council launched a document targeting the construction industry: Technical Guidelines for Retrofitting Existing Buildings. The document has been compiled by local experts and is suited to the particular requirements of local buildings, which are highly specific due to the region's climate.

Besides helping reduce energy demand, building retrofits have a number of other benefits. They help increase the longevity of buildings, generate savings for building owners, reduce the carbon footprint and improve indoor environmental conditions. This is why the UAE will be taking further steps to ensure the quality of the existing building stock in the country is quickly improved. ■

**in Dubai alone, some 30,000 of the 120,000 existing buildings can accommodate retrofit programmes**

### ABOUT ENG. SOMAYYAH AL YAMMAHI



She joined the Ministry of Energy in 2013 as a senior green building architect in the Energy Efficiency and Conservation department, where she is responsible for following up the EE and EC initiatives by analyzing data. Moreover, she is responsible for coordinating the work of the Emirates Energy Conservation Team. In addition to supporting the municipalities in knowledge and information of green building technologies to enhance their legislation and codes. She has a Bachelor of Architectural Engineering from the United Arab Emirates University.



1| Energy End-Use: Buildings,  
<http://bit.ly/1Uln4WIH>



FACT BOX

By  
Stephane le Gentil

# DEWA RETROFITS: LESSONS FROM THE FIRST PROJECTS

## DUBAI ELECTRICITY AND WATER AUTHORITY'S BUILDINGS ARE GETTING AN UPGRADE AND ARE PROVING FIRST-HAND THE PROFITABILITY OF BUILDING RETROFITS

Etihad ESCO came into existence through a special mandate of the Dubai Electricity and Water Authority (DEWA) and therefore made its initial focus the retrofitting potential of DEWA facilities. The projects entrusted to Etihad ESCO were the Jebel Ali and Al Awir power station lighting retrofit and the retrofit of seven DEWA buildings across Dubai, including the head office.

DEWA realised from this first attempt that they would have to invest AED 37 million in the project, but that overall energy savings would be 68% for lighting and 31% for buildings, with payback expected in three and a half to six years.

These first projects have established that technical solutions that enable reductions in power consumption do exist in the Dubai market. This is because ESCO capabilities in Dubai are developing rapidly. The number of ESCOs, too, is rising to meet demand. In a matter of 12 months, the Dubai Regulatory and Supervisory Bureau has accredited nine ESCOs through its accreditation scheme.

There is little doubt that the UAE ESCO framework is working well – with standard contracts that are balanced, and well adapted to the market. This fact, coupled with the news of energy savings, has established the ESCO model firmly in the region – at least at the grass-root level.

The 2015 Directive for Audits and Retrofit Plans for Dubai Government Entities is efficiently creating a strong movement in favour of Dubai Government building retrofitting. There is the potential for massive energy savings that, in the short term, will increase overall efficiency. ■

### ABOUT STEPHANE LE GENTIL



He is the CEO of Etihad ESCO. Etihad ESCO was set up in 2013 by the Dubai Supreme Council of Energy and Dubai Electricity and Water Authority as the official government organisation to help drive lower electricity and water consumption in Dubai's existing buildings.

# AN ENERGY VOX POP

**DUBAI'S ENERGY REGULATOR ON WHAT THE CITY'S RESIDENTS THINK ABOUT ENERGY ISSUES**



By  
**Graeme Sims**

Engaging individuals in the drive to improve energy efficiency has become an increasing preoccupation of policy-makers worldwide. This preoccupation has been accompanied by a growing recognition that developing regulations that seek to influence behaviour will only be successful if grounded in a nuanced understanding of what motivates consumers, what obstacles they face and the assistance that will best help them. It was the acknowledgement of the importance of these issues that led Dubai's energy regulator, the Regulatory & Supervisory Bureau, to commission market research into householders' attitudes on energy and water use. The survey sought views from 571 Dubai residents, a mix of Emiratis and expats, homeowners and renters.



**58% said they were highly concerned about being efficient in their use of energy and water in the home**

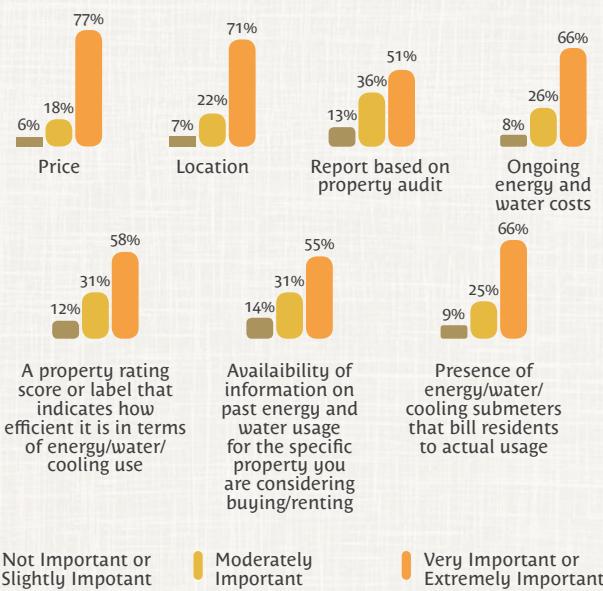
## The importance of energy issues

A number of questions sought to establish how important energy and water were to those surveyed. A total of 78% agreed that climate change is a real problem, at least partially caused by human action, and that steps should be taken to mitigate it. 58% said they were highly concerned about being efficient in their use of energy and water in the home. On bills and prices, there was a mixed picture: 51% thought they were low to about right and 46% thought them high but 70% were very or extremely interested in lowering the amount they pay.

We were also keen to understand where energy sits compared to other factors when selecting a property to buy or rent. As expected, price and location were the most important factors, but meters that allow billing for actual usage were seen as very or extremely important by two thirds of respondents. Ongoing energy and water costs were seen as almost as important and there was strong support for labels, information on past usage and audits, all of which inform the question of likely future costs.



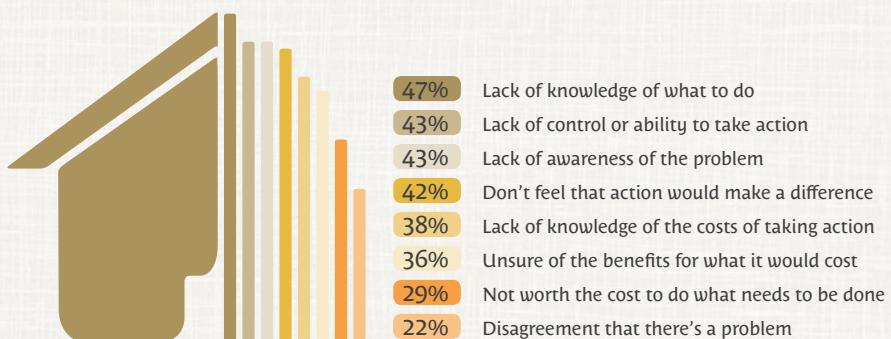
**Figure 1: Importance in the property search and selection process**



## Barriers to more efficient use

The survey clearly identified that energy and water matter to those we surveyed. We next sought to understand what was getting in the way, if anything, of consumers taking action to improve efficiency and reduce usage. Knowledge, control and awareness came out as the top barriers. Consistent with earlier findings on perception of the problem, there were only low levels of disagreement that there was a problem or that action wouldn't be cost effective.

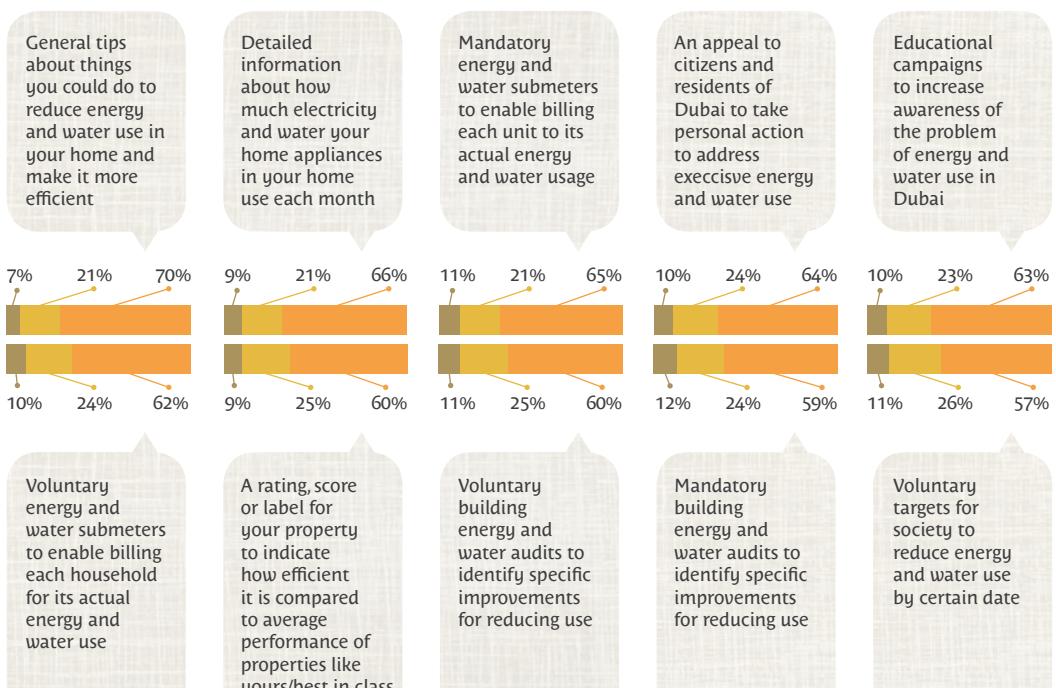
**Figure 2: Barriers to reducing consumption at your home**



## What would help?

With barriers identified, we sought to establish the kinds of informational and incentive mechanisms most likely to cause residents to adopt more energy and water efficient measures. All the options canvassed received solid support, but coming out on top were measures providing information, with meters that allow consumers to take more control over what they spend.

**Figure 3: Likelihood of adopting energy and water efficiency measures**



■ Extremely Unlikely or Somewhat Unlikely

■ Moderately Likely

■ Extremely Likely or Somewhat Likely

## ABOUT GRAEME SIMS



He is the Executive Director of Dubai's Regulatory and Supervisory Bureau. An Oxford-educated economist, he has over 20 years' experience of utility regulation in the UK and the UAE.

Delivery of Dubai's energy strategy will involve all of the Emirate's residents in making better informed and motivated choices to improve energy and water efficiency – in where they choose to live, in the equipment and appliances they purchase and in their behaviour. Equipped with research such as that discussed here, we, and others with a responsibility to help consumers make these choices, can design frameworks and programmes that are themselves well-informed and motivated. ■

# WHAT'S HOLDING BACK THE PRIVATE SECTOR?

## BARRIERS AND SOLUTIONS FOR ENERGY AND WATER EFFICIENCY FOR UAE CORPORATIONS



COMMENTARY

By  
Nadia Rouchdy

The International Energy Agency (IEA) asserts that implementing energy efficiency is a major opportunity to sharply reduce greenhouse-gas emissions so that warming does not exceed the threshold of 2°C, beyond which the planet will face the dire consequences of climate change. By 2020, energy efficiency could provide 49% of the emission reductions required to stay below this threshold<sup>1</sup>. Additionally, the fiscal case for accelerating energy efficiency has never been clearer, with the sector worth USD 310 billion/year<sup>2</sup>.

Locally, the UAE has seen considerable economic and urban development, resulting in 33% of emissions coming directly from the power sector. With electricity and water produced by co-generation plants, it is clear that the need to curb consumption of both resources is critical in reducing emissions.

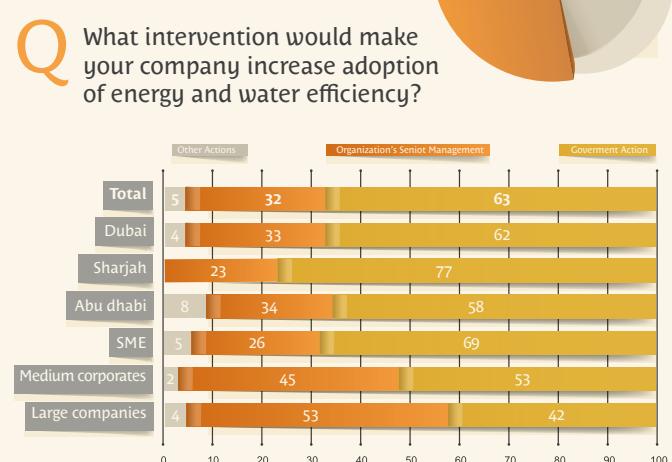
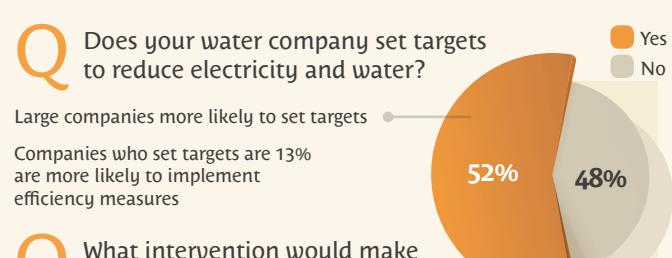
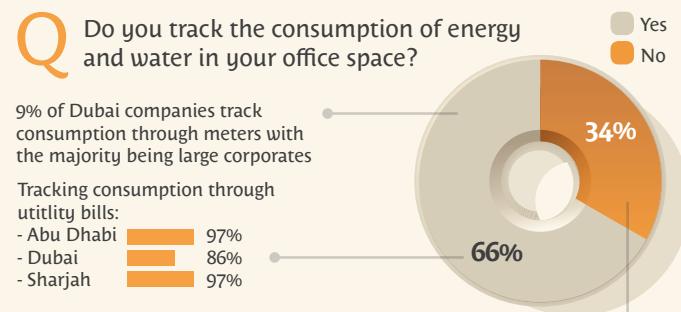
Government buy-in for energy and water efficiency has been heightened due to increasing demand projections, the opportunity costs of exporting oil, meeting peak demand in summer months, ensuring energy security and reducing government spend on subsidies. Additionally, energy and water efficiency has been highlighted in the UAE's Green Economy Agenda and will contribute to positive economic benefits such as creating up to 165,000 jobs and reducing the UAE's cumulative emissions by 18-25% between 2013-30<sup>3</sup>.

Even amidst the clear business case for efficiency investment and deployment, the opportunity has not yet been fully realised, with projections of two-thirds of global energy efficiency potential likely to remain untapped until 2035, unless policies change and barriers are lifted<sup>4</sup>.

During our engagement in Heroes of the UAE, an energy efficiency and emission reduction initiative by EWS-WWF which ran from 2011-2014, it was evident that businesses face a number of barriers in the implementation of energy and water efficiency. In a quest to discover priority barriers and identify key solutions, EWS-WWF began to investigate the topic in more depth, with the first statistically representative survey of the private sector on energy and water efficiency barriers and solutions conducted in 2015.



We set out to understand in aggregate form the private sector's views on the most critical barriers hindering wide-scale efficiency, and to begin prioritising solutions. A total of 363 face-to-face interviews were conducted in English and Arabic, with employees tasked with energy and water management in Abu Dhabi, Dubai and Sharjah. The results are as follows:





1

**Barrier:** Technology Cost

**Explanation:** When high costs of energy and water efficiency technologies discourage companies to invest.

**Percentage of respondents:** 37%

2

**Barrier:** Product Availability

**Explanation:** When products on the market are unavailable, too few, lack variety, do not include efficiency information on the label, have false labels or are sub-par quality.

**Percentage of respondents:** 34%

3

**Barrier:** Market Accessibility

**Explanation:** When there is little or no information on where products are sold, making the marketplace for energy and water efficiency products less accessible to consumers.

**Percentage of respondents:** 27%

4

**Barrier:** Subsidy Awareness

**Explanation:** When decision-makers are not aware of subsidies in tariffs, leading them to misunderstand the potential value of energy and water efficiency.

**Percentage of respondents:** 25%

5

**Barrier:** Too much focus on awareness

**Explanation:** When organisations solely promote behavioural changes such as turning off lights as a strategy, as opposed to combining awareness with retrofitting.

**Percentage of respondents:** 21%

**ABOUT  
NADIA ROUCHDY**



She is the Senior Climate & Energy Officer at EWS-WWF and supports the Climate & Energy Programme by spearheading the development of energy efficiency and climate change risks research, and in driving strategic partnerships in the public and private sector.

In order for the private sector to participate in reducing their contribution to the UAE's emissions there needs to be a clear indication that barriers will be lifted and incentives, schemes and programmes will be available to facilitate implementation. Key conclusions include:

Given that the UAE's small and medium enterprise (SME) sector contributes to more than 60% of the country's GDP<sup>s</sup>, it is important to consider efficiency solutions based on company size. SMEs will need a basket of solutions to accelerate their participation and uptake of energy and water efficiency initiatives.

Whilst businesses have identified the need for government action on efficiency, there is contradiction in the solutions for the prioritised barriers, requiring a mix of public and private sector involvement. This highlights the need for a multi-sector approach to tackle key barriers, requiring strong collaboration between public and private sector players to deliver and implement solutions. The government should provide regulation to support the advancement of efficiency, and the private sector will need to be heavily involved in implementing and delivering the solutions in this transition.

In order to continue to build on the results of the survey, EWS-WWF then developed issue papers on the prioritized barriers, which identified the context of the barriers and their implications for the private sector. The papers were then used in stakeholder consultations during roundtable discussions and will inform EWS-WWF's final position paper to further assist the UAE private sector in its journey to a green economy. ■

To obtain the full survey results or issue papers, please contact [nrouchdy@ewswwf.ae](mailto:nrouchdy@ewswwf.ae)



- 1| IEA. 2013. Redrawing the Energy-Climate Map.
- 2| IEA. 2014. Energy Efficiency Market Report.
- 3| MoEW. 2014. UAE State of the Green Economy.
- 4| IEA. 2014. Capturing the Multiple Benefits of Energy Efficiency
- 5| Sadaqat, R. The Khaleej Times. 2014. Strong SME sector charges into 2015

# SMART, SUSTAINABLE CITIES

**A LOOK BEHIND  
THE TERM AND THE  
HOLISTIC APPROACH OF  
INTEGRATING INTELLIGENT  
PHYSICAL INFRASTRUCTURE  
AND SMART SYSTEMS WITH  
SUSTAINABLE DEVELOPMENT**



By Eng. Mohammed  
Al Mutawwa

With a rapidly growing world population, currently numbering over 7.3 billion people, and almost two thirds of that number living in cities that are producing more than 60% of the greenhouse-gas emissions accelerating the impacts of climate change on our planet Earth, comes the need to adapt the concept of sustainability and sustainable developments.



**Nowadays the idea of smart cities has emerged, but how is that different than sustainable cities?**

The definition of sustainable development is development that meets today's needs without compromising future generation's needs. A smart city is a city with well-developed Information and communication technologies (ICT) that meet the increasing demand of the population. The Dubai Government has launched a strategy to transform Dubai into a smart city through identifying 100 initiatives with six main components or pillars of a smart city: smart economy, smart mobility, smart environment, smart people, smart living and smart government. Under the strategy, 1,000 government services are set to go smart by 2017. In April 2014, in recognition of achievements in this area, Dubai was crowned the MENA Smart City of the Year at the TMT MENA 2015 awards. Abu Dhabi pursues this transition through its Smart City agenda, with the concept of Masdar City being the first prime example in the region.



UNITED ARAB EMIRATES  
MINISTRY OF ENERGY

Smart city initiatives have gained momentum in the GCC in recent years, with three countries announcing projects for future smart cities; six greenfield economic cities in Saudi Arabia, complemented by efforts to uplift cities such as Mecca toward Smart City status; three projects in Qatar (Lusail's Smart and Sustainable City, Pearl-Qatar Island and Energy City Qatar); and two projects in the UAE (Masdar City in Abu Dhabi and Smart City Dubai).



## ABOUT ENG. MOHAMMED AL MUTAWWA



He is the Head of Energy efficiency policies at the Department of Energy Efficiency and Conservation, Ministry of Energy. He currently works on various projects that will support and enhance energy efficiency practices on a federal level. Mohamed Holds a Bachelor's degree in Architectural Engineering from the United Arab Emirates University. Mohamed worked previously at the Abu Dhabi Urban Planning Council as a Planning professional.

Some examples of smart systems that can be implemented throughout a city are having smart buildings and smart building controls, which can be achieved through building codes for new buildings and existing building retrofitting programmes through Energy Performance Contracting (EPC) and having energy management systems in place, resulting in more efficient use of energy in buildings, given that buildings consume more than 60% of the total energy produced.

Having smart grids in place is key for having efficient and reliable energy networks. Smart metering allows for real-time data monitoring and analysis, but in order to ensure efficient use by consumers, public awareness and consumer education programmes must also be in place. In this context, smart meters allow the consumer, probably through smart phone applications, to have access to their electrical consumption data and on top of that, if a feed-in-tariff policy is executed, it will incentivise people to use renewable energy and allow them to know how much electricity they are contributing to the grid.

One of many local and international efforts in highlighting the importance of smart sustainable cities is the Global Sustainable Cities Network (GSCN) initiative led by the UAE, with participation from Sweden, France, China, Finland and Russia. This initiative is part of the Clean Energy Ministerial (CEM). It functions as a knowledge-sharing and matchmaking platform for representatives of the CEM countries with policymaking and procurement responsibilities in city management. Other initiatives are the United Nations Human Settlements Program UN-Habitat and the C40 Cities climate leadership group.

As defined by the United Nations – ITU, a Smart Sustainable City (SSC) is an innovative city that uses Information and Communication Technologies (ICT) and other means to improve quality of life, efficiency of urban operation and services and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects. In order to have a smart and sustainable city, a holistic approach integrating intelligent physical infrastructure and smart systems with sustainable developments is needed. This starts with strategic sustainable planning and development, highlighting necessary mitigation actions and measures regarding the results of having these smart systems and developments, and ends with having a smart governance system between the active stakeholders. ■



LINKS

SMART CITIES IN THE REGION

( <http://www.tmtfinance.com/mena/>)

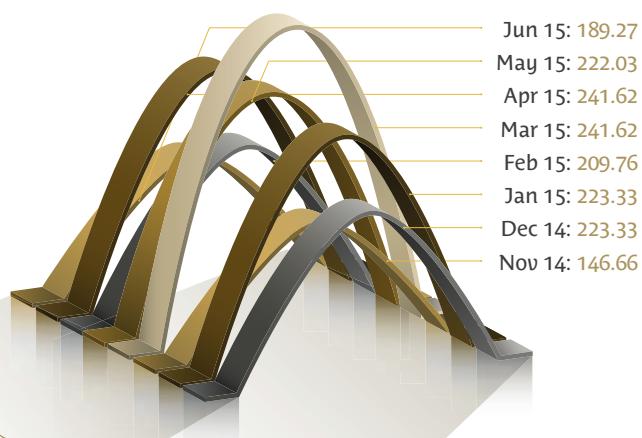
# UPDATE ON THE DUBAI TRAM

**ALMOST ONE YEAR AFTER THE START OF OPERATIONS, THE MIDDLE EAST'S FIRST TRAMWAY HAS BECOME AN INTEGRAL PART OF LIVING IN DUBAI MARINA**

The Dubai Tram launched in November 2014 and lays claim to several world firsts. It is the first turnkey tramway or light-rail system in the Middle East, the world's first with full-line third-rail ground-based Aesthetic Power Supply (APS), the first designed for such extreme weather conditions and the first with platform screen doors and automatically synchronised station stops. Its ground-based power supply system employs leading-edge technology which energises the current rail beneath the tram as it passes. This is considered safer than conventional overhead catenary-type systems. The passenger platform in each tram station spans 45 metres and Dubai is the first tram system in the world equipped with full platform screen doors. These fully align with the tram doors' opening and closing mechanism to provide maximum convenience, safety and security for passengers.

The current route length is 10.6kms, with further extensions planned. It starts at Dubai Marina and finishes at the tram depot next to the Dubai Police Academy at Al Sufouh. The track is mainly at grade, except for some parts within Dubai Marina where it is elevated on a viaduct due to design requirements. The current network has 11 stations covering densely populated areas along the tramway line, of which seven stations are at grade and four stations are elevated. Dubai Tram is integrated with the Dubai Metro, buses and taxi services to enhance city connectivity.

Estimated amount of carbon emissions removed from Dubai roads (tCO<sub>2</sub>)



By AbdulMohsin Ibrahim Younes



Moreover, platform screen doors help reduce the loss of energy in cooling the tram cars by retaining cool air within the car interiors and platform area. The system is designed to tolerate climate extremes, including high temperatures of up to 50 degrees Celsius as well as high humidity and the desert environment.

It is projected that shifting from using private vehicles to use of the tram will reduce more than 6,000 tonnes of CO<sub>2</sub> emissions annually. The tram served 2,385,508 passengers during the period from November 2014 till June 2015, which has removed around 1,660 tonnes of CO<sub>2</sub> and this is expected to rise to more than 16,000 tonnes as the increase in ridership reaches expected levels of 24,000,000 passengers by 2020. Currently, the average amount of carbon removed on a monthly basis is 207 tonnes and the average daily is 7,214 kgs. ■

## ABOUT ABDULMOHSIN IBRAHIM YOUNES



He is the Chief Executive Officer for the Rail Agency, at the Roads and Transport Authority, Dubai. He has more than 24 years of senior leadership experience in the public sector. Being fully committed to RTA's vision "Safe and smooth transport for all", his role and responsibilities allows him to direct rail plans, studies, designs, construction, operation & maintenance of rail transport systems in Dubai and to supervise developers, contractors & consultants undertaking such tasks.



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# SUSTAINABILITY AT THE FEDERAL ELECTRICITY AND WATER AUTHORITY



By H.E. Mohammed  
Mohammed Saleh &  
Nourah Salem

**Sustainability is becoming an increasingly important topic for the UAE energy sector and all utilities are considering the social, environmental and economic impact when putting new strategies, goals and initiatives in place. Today, every authority, government and public and private entity has aligned its planning to the UAE Vision 2021, which highlights sustainability in a broader scope. The Federal Electricity & Water Authority (FEWA) is introducing a number of sustainability initiatives designed to influence consumer behaviour and promote the efficient use of energy and water. Those sustainability initiatives range from solar power stations and the rationalisation of water and electricity consumption to e-billing and environmentally friendly chemicals.**

In addition, FEWA continues to employ measures that reduce the carbon footprint of both its operations and its customers. In 2013, H.E. Suhail Mohammed Al Mazrouei, Minister of Energy Chairman, FEWA Board of Directors, launched a conservation campaign, which aimed at rationalising the usage of water and electricity. The conservation campaign highlighted three main areas.

Partnering with local and federal strategic partners to develop more initiatives to help support the main aim behind the campaign and the UAE Vision 2021

Encouraging customers to change consumption behaviour to increase efficiency levels

Adopting and implementing initiatives for the sake of innovation and sustainability

"Together...change is possible" is the campaign slogan. Studies have showed that the average electricity and water consumption per capita in the UAE is double that of the global average. This explains the importance of rationalisation in securing resources for future generations. Highlighting such a topic to the public is important as it will ultimately have a positive impact on the environment and protecting our resources will help ensure the availability of these resources for future generations.

In 2015, FEWA launched the Emirates Conservation Award to raise awareness regarding the benefits of energy and water conservation and to reward the most efficient customers. The award is divided into four categories; housewives, schools, mosques and governmental buildings. In June 2015, 18 families were awarded with prizes ranging from AED 5,000 to AED 10,000. The campaign aims to educate consumers on the importance of conservation and to encourage the adoption of innovative solutions.

The authority is planning to develop renewable-electricity generation to promote efficiency and sustainability. Following the experience of Masdar in Abu Dhabi, FEWA has set its strategic plan to build a 100MW Ground Based PV Solar Plant. This 100MW Plant will deploy cost-effective and reliable solar modules and integrate technologies and components that deliver efficient operation for over 25 years, as well as design and installation solutions that combine the lowest costs per kWh with the highest reliability in long-term operation and maintenance. Such an approach has many important benefits for the environment. These benefits include the reduction of carbon dioxide emissions, a decrease in the consumption of fossil fuels, conversion of desert wastelands into natural resources and promoting sustainability.



**FEWA has set its strategic plan to build a 100MW Ground Based PV Solar Plant With “Together.. change is possible” as a campaign slogan (...) FEWA publicised that the average electricity and water consumption per capita in the UAE is double that of the global average**

As part of its objective to shift to e-services and cut down on the need to visit FEWA offices, thereby reducing the wastage of paper, FEWA will soon launch its environmental e-bill initiative, allowing customers to pay online. The new bills will provide consumers with information regarding environmental behavioural impact, the amount of consumed energy and water and the corresponding charges. The bills will also highlight the greenhouse-gas emissions released into the atmosphere and the carbon footprint.

FEWA is one of the first in the region to be developing a performance-based slab system, which classifies customers into different groups based on consumption. The slabs were created after rigorous analysis of historical data, detailing the usage of different customer groups over three years. Several customer groups were established and each has a corresponding slab. The system was also developed to account for seasonal changes in energy and water use. Social sciences have proven that this is an effective method to influence consumer behavior and enforce positive habits. It relies on findings from behavioural science, which reveal that comparison with peers is a strong motivator for individuals.

The new billing initiative required FEWA to develop a detailed grid of emission factors, determining the emissions associated with energy and water production. The main inputs for the model were statistics related to FEWA's fuel combustion for electricity and water production, production details and import statistics. The emissions were accounted for in line with the ISO 14064-1 standard. In order to develop this initiative, FEWA partnered with Dubai Carbon and is further exploring the potential of public-private partnerships for implementation.

To have a positive impact on the environment and meet FEWA's corporate social responsibilities, the objective is to actually have no impact on the surrounding environment, particularly in regards to the authority's vital role in the desalination of water. FEWA takes into consideration all the factors that can harm the environment. Those factors range from design and construction to operation and the use of chemicals or biochemical products.

FEWA will continue to study new efficiency initiatives that will help protect natural resources and secure them for future generations. Sustainability will continue to be a focus for FEWA and the authority will continue initiating measures to reduce the carbon footprint of its operations and customers. The authority is planning to develop customer-specific energy conservation tips and encourage adoption. FEWA will also expand the penetration of the e-bill, progressively reducing paper bills. ■

## ABOUT **H.E. MOHAMMED MOHAMMED SALEH**



H.E. is the Director General of the Federal Electricity & Water Authority (FEWA) and has over 33 years of experience in the utilities sector.

## ABOUT **NOURAH SALEM**



She is a recent American University of Sharjah Graduate, holding a Bachelor's Degree in Mass Communications. She recently joined the Federal Electricity & Water Authority (FEWA) as an analyst at the Director General's office. She strives to promote public awareness of FEWA's services and projects. She is also a member of the Innovation Team.

# RECYCLING IN DUBAI'S COMMUNITIES



ARTICLE

By Habiba  
Al Marashi



FACT BOX

## THE ECOLOGICAL FOOTPRINT

measures a nation's impact on Earth, to highlight whether a country and its people are living within the limits of our planet. It is calculated by comparing consumption of natural resources with nature's ability to renew those resources. See more at: <http://uae.panda.org>

## The problem of waste in the UAE

The United Arab Emirates (UAE) has transformed into a modern, impressive nation within a relatively short period of time, due to the abundance of oil and ambitions. To galvanise the transformation, the UAE has relied heavily on the import of other resources, including material and manpower. The population of the country jumped significantly due to the influx of foreign workers, as it provided world-class amenities to attract the required human capital. The resultant urban development exacted a toll on the environment. An international report by the World Wildlife Fund (WWF) in 2008 referred to the country's burgeoning ecological footprint, attributable to natural-resource consumption, a high standard of living and waste. While it elicited widespread concern, little was known about how to recover waste that went to landfill every year.

Meanwhile, a local non-governmental organisation jumped to the fore more than a decade ago to engage the community and other sectors in environmental protection, focusing heavily on resource optimisation, waste management and recycling.

## Initiating the reduce, reuse and recycle practice

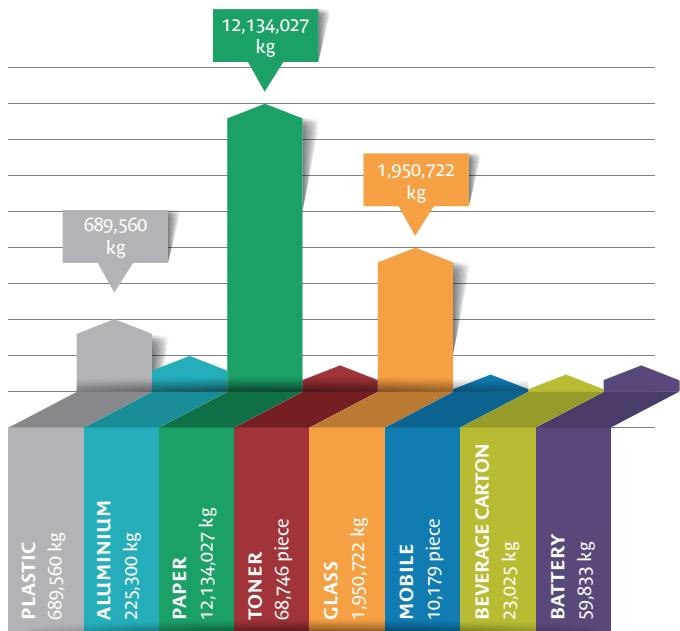
Pioneering the first of eight recycling programmes in 1997, Emirates Environmental Group (EEG) commenced by targeting its growing network of members. Buoyed by the success of the annual Can Collection Campaign in the collection of recyclable aluminum cans, EEG consecutively launched similar programmes for the recycling of paper, plastics, glass, toner cartridges, mobile phones and accessories and beverage cartons, as well as the collection of household batteries. Participants, including offices, factories, hotels, supermarkets, schools, universities and households, spanned all the seven Emirates. They were clustered into three broad categories: companies, schools and families. Two one-day drives to collect cans from the public and a national clean up campaign complemented the year-round collection of recyclables and waste.

A number of special projects were designed to make recycling a rewarding practice. An annual award ceremony for recycling champions is held on the occasion of World Environment Day on June 5 every year. Short summer campaigns involve students in collecting recyclables from their neighbourhoods during the school break, community campaigns motivate members of the public to experience the pleasures of recycling, companies are provided the opportunity to sponsor recycling centres in schools and so on. The success of these projects hinges on the commitment of people from all walks of life. This is ensured by tagging successful collections of given quantities of waste items and offering the opportunity to plant trees in participants' names. This structured and innovative approach to community waste management and recycling has ensured the sustainability of the programmes, resulting in an increased uptake of recycling among key sectors of society.

## Gearing up for the SDGs

These unparalleled programmes have been pivotal in raising the profile of community recycling in the UAE. Every year, substantial quantities of domestic solid waste are diverted away from landfills and dispatched to local recycling and waste handling facilities. Goal 11 of the proposed sustainable development goals (SDGs) states, "Make cities and human settlements inclusive, safe, resilient and sustainable," and the corresponding target no. 11.6 aims at reducing the adverse per capita environmental impact of cities by 2030, by paying special attention to air quality, municipal and other waste management. EEG's comprehensive waste management and recycling programmes will gear up to help the UAE meet these objectives and targets in the years ahead.

## Collected materials per sort since 1997



### ABOUT HABIBA AL MARASHI



She is the Co-founder and Chairperson of Emirates Environmental Group (EEG). EEG is a pioneering organisation based in Dubai. She has played a key role in the growth of the EEG, which is an active multi-sectoral organisation that has successfully brought the UAE government, private sector and community under the same banner. She was the first Arab woman to become a board member of the UN Global Compact and is a member of the Global Reporting Initiative (GRI) Stakeholder Council.



Participants, including offices, factories, hotels, supermarkets, schools, universities and households spanned all the seven Emirates

### Since Inception EEG Recycling Programmes have:



Mitigated 53,832 metric tonnes of carbon dioxide emissions, equal to 11,333 passenger cars off the road for one year



Saved 81,061 cubic metres of landfill space, equal to 32 Olympic-sized swimming pools



Saved a total of 213,368 trees from being felled, equal to 3,415,104 square metres of land area which equals the forested area of Greenland



In total, EEG's campaigns have involved over 2,400 participating entities over the years, collecting a total of over 15,000 metric tonnes of material along with over 68,000 toners and over 10,000 mobile phones thus far. In 2014 alone, the campaign collected 1,605,413 kilogrammes of waste composed of 25,807 kilogrammes of cans, 1,172,515 kilogrammes of paper, 81,725 kilogrammes of plastic, 315,042 kilogrammes of glass, 4,169 kilograms of batteries and 6,155 kilogrammes of beverage cartons. The materials are segregated at source, brought to EEG recycling centres in easy-to-access places in the UAE and then passed on to UAE-based facilities or corporate partners for material recovery and recycling. ■

**Bottom Line**

# THE UAE ON THE RIGHT TRACK

## THE POTENTIAL OF THE SHIFTING ENERGY CONSUMPTION AND DEMAND IN THE MIDDLE EAST

Based on the latest figures published by the International Energy Agency (IEA), global energy demand is set to grow by 37% by 2040, but the development path is for a less energy-intensive world. The expectation is that growth in global demand will likely slow over time, from above 2% per year over the last two decades to 1% per year after 2025. As energy demand flattens out in much of Europe and North America, it will continue to rise in the rest of Asia, Africa, the Middle East and Latin America.

It is interesting to note from the same source that the global economy grew by around 3% in 2014, but energy-related CO<sub>2</sub> emissions stayed flat over the same period, the first time in at least 40 years. At the same time, energy intensity dropped by 2.3%, a result stemming from improved energy efficiency and structural changes in some economies. Albeit a good step, this will not be enough to reach the goals set out by the global community to reduce carbon emissions by 80% in 2050.

Energy efficiency will have to play a critical role in order to achieve such goals, and this will be especially true for the Middle East, where expectations are that energy demand will continue to rise at a higher rate than other regions of the world. As it happens, the Middle East is one of the regions where energy efficiency has not made significant progress in the past and therefore, tremendous opportunities exist in all sectors.



By  
Pierre Langlois



**this will not be enough to reach the goals set out by the global community to reduce carbon emissions by 80% in 2050.**



### USD 310 BILLION

The annual worth of the global energy efficiency market, which is still growing.

The value of electricity wasted in 2013 due to not implementing best available technologies and solutions in network-enabled devices.



As in all markets, such opportunities will require much effort and adapted tools will need to be developed. Among these will be:

Stronger legal and regulations to impose mechanisms (building codes, standards, use of taxes, adapted tariffs etc.) to ensure an increase in efficiency across all aspects of the economy

Increased presence of utilities through adapted programmes to increase awareness and stimulate and support different market segments in becoming more efficient in their use of energy

Development and support of adapted intermediaries (product manufacturers and distributors, construction contractors, consultants, Energy Service Companies) that will be needed in high enough numbers to develop the market and provide the required equipment and services for project implementation

the global economy grew by around 3% in 2014 but energy-related CO<sub>2</sub> emissions stayed flat over the same period

Adapted financing mechanisms to transform the market, in order to provide the necessary access to financing to enable implementation of the developed projects

A good regulatory process to evaluate achievements, correct courses of action as necessary and enable the market to develop in order to meet the set goals.

Some countries, like the United Arab Emirates and Saudi Arabia, have started to act strongly in this direction and have set up structures, tools and mechanisms following this path. Such initiatives are still relatively new and results are as yet undetermined, but we can already see the impact of some of these initiatives. The dynamism of the different stakeholders and the aggressive search for adapted solutions to specific barriers are all good signs and will guide the way for other countries in the region.

The next 20 years will be pivotal in regards to the Middle East making a major shift in the energy sector, going from a fuel-based and fast-growing energy demand region to a high-efficiency, low-carbon one. This can only be done with a contribution from renewable energy in the energy mix and through major effort on the energy-efficiency side. As one of the most rapidly developing regions in the world, the UAE will have to become innovative in approaches to the problems, with solutions developed and adapted to their own reality. Copying what has been done in other OCDE countries is not an option. We can therefore expect new innovations to come out of this region and contribute to developing energy-efficiency initiatives globally and reducing the associated CO<sub>2</sub> emissions. ■

## ABOUT PIERRE LANGLOIS



He is recognised as an international expert in the development and implementation of pioneering energy-efficiency financial mechanisms in industrialised and developing countries, with more than 25 years of experience in over 50 countries. As President of Econoler, he is involved in many city-level energy-efficiency initiatives around the world, including in the Middle East.





# ENERGY, ECONOMY & INDUSTRY

HIS EXCELLENCY  
DR. SULTAN AL JABER  
MINISTER OF STATE, UNITED ARAB EMIRATES  
CHIEF EXECUTIVE OFFICER, ENERGY, MUBADALA  
CHAIRMAN, MASDAR



Sustainability and innovation are core pillars of the UAE's economic development strategy. These pillars, along with human capital, have helped increase our global competitiveness and position the UAE as an incubator of the newest technology.

In many sectors throughout our economy, we are optimising industrial performance by forging partnerships and developing innovative technologies to ensure we maximise the energy efficiency and sustainability of our industries in order to assure continued economic prosperity.

For example, researchers at the Masdar Institute of Science and Technology have designed an innovative, high-grade and lightweight steel – a next generation material – that will be

used to improve fuel efficiency in the transport sector and help reduce carbon emissions. Additionally, Masdar's partnership with ADNOC is leading to the development of an industrial-scale carbon capture, usage and storage (CCUS) network, which will help create a low-carbon power-generation industry and contribute to reducing the UAE's carbon emissions.

As we look to the future, we will concentrate on efforts that optimise our efficiency and enable us to take on a larger leadership role in pioneering energy efficiency technologies. By doing so, we will create jobs in new industries while strengthening infrastructure that supports our healthy economy.

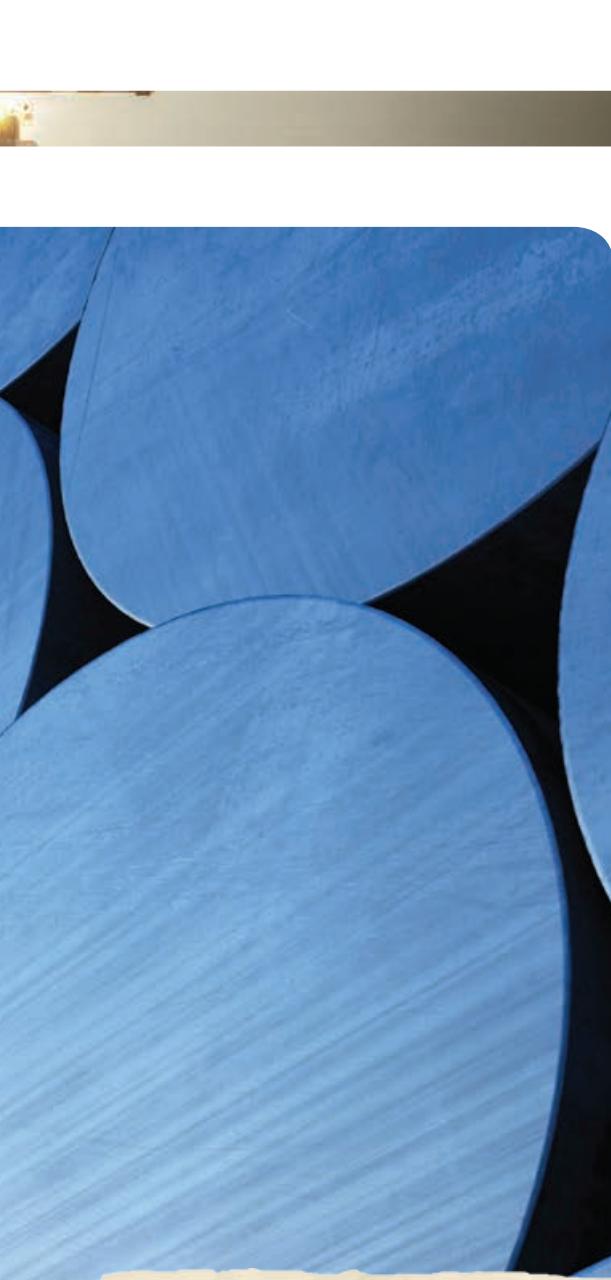
# RESPONSIBLE ENERGY CONSUMPTION – AN INDUSTRY COMMITMENT



MAIN REPORT

By H.E.  
Abdulla Kalban





**With an annual production capacity of 2.4 million tonnes of high-quality molten aluminium, Emirates Global Aluminium (EGA) ranks amongst the top five largest primary aluminium producers in the world. With its entire production pre-sold each year, the EGA's two core operating subsidiaries: Dubai Aluminium (DUBAL – also known as EGA Jebel Ali); and Emirates Aluminium (EMAL – also known as EGA Al Taweelah); consistently operate at full capacity. Given that it typically takes 13.9MWh to produce one tonne of aluminium, maintaining this operating level demands a substantial amount of electrical energy.**



**The combined power generation capacity of DUBAL and EMAL is 5,450MW, which represents approximately 20.2% of the 27GW of installed capacity in the UAE**

The demand is satisfied internally by the captive power stations integral to both smelter complexes. The combined power generation capacity of DUBAL and EMAL is 5,450MW, which represents approximately 20.2% of the 27GW of installed capacity in the UAE. This makes EGA an important player in the UAE energy sector.

EGA acknowledges its responsibility in this area by applying sustainability principles. For starters, the DUBAL and EMAL power plants are configured towards cogeneration and combined cycle operation. Chemical energy from fuel is converted into heat through combustion. The heat then passes through gas turbines where it is converted into mechanical energy, which is then converted to electricity using generators. The resulting alternating current (AC) is converted into direct current (DC) by rectifier transformers for use in the aluminium reduction process. The gas turbines contain heat recovery steam generators (HRSGs) which produce steam, thus providing fuel-independent energy to generate power from steam turbines.

The DUBAL power plant has 23 gas turbines and seven steam turbines, supplying on-site power for DUBAL as well as externally to nearby customers. Approximately 27% of the power generated at DUBAL is fuel-free. In addition, waste heat from the DUBAL power plant is used to produce potable water through a seawater desalination plant. The EMAL power plant has nine gas turbines (eight fitted with HRSGs) and four steam turbines, supplying on-site power for its operations – including a reverse osmosis seawater desalination plant. Some 34.8% of the power generated at EMAL is, therefore, fuel-free. ▶

## Optimisation

Although the DUBAL and EMAL power plants make both operations effectively self-sufficient in terms of energy requirements, the broader sustainability agenda at EGA is translated into ongoing efforts to minimise power consumption. Through optimisation efforts, the thermal efficiency of the DUBAL power plant has improved over the years and in 2013, it reached its highest-ever level of 46%. Greater thermal efficiency means increased power generation to produce hot metal, while the fuel requirement increment is proportionately less – with direct environmental benefits in terms of fossil-fuel combustion and associated environmental emissions.

Further demonstrating EGA's commitment to energy optimisation, the business has developed and implemented some of the most advanced reduction-cell technologies available in the world. EGA's proprietary DX and DX+ Technologies, both deployed on an industrial scale at EMAL, operate at higher amperage levels. This yields higher productivity and translates into lower specific-energy consumption (below the industry norm) with associated reductions in both fossil-fuel combustion and environmental emissions.

## Environmentally friendly

EGA's commitment to protecting the environment is also evidenced by the DUBAL and EMAL power plants' operation primarily on natural gas (the 'cleanest' type of fossil fuel), which contributes to reduced air emissions (distillate is used only in the event of shortages or emergencies). The best available technologies are deployed to further reduce air emissions during the power production process. For instance, EGA's large gas turbines are fitted with dry, low nitrogen oxide (NOx) burners, which allow the gas to be burned at a lower temperature, resulting in lower NOx emissions.

At EMAL, essential upgrades on the Phase I gas turbines during 2014 included a combustion system upgrade from the existing Dry Low NOx ("DLN") 2.0 technology, to the most advanced DLN2.6+ reduced combustion system on the four combined-cycle gas turbine units and installation of cooling optimisation and compressor upgrade packages for all six Phase I gas turbines. This effectively reduced the EMAL power station's NOx emissions by 1,200 tonnes per annum and carbon dioxide (CO<sub>2</sub>) emissions by 917.725 tonnes.

## Alternative energy sources

Although the location of DUBAL and EMAL in the Middle East ensures an abundant source of energy, primarily oil and natural gas, EGA strongly supports national and regional efforts to find and adopt alternative energy sources. Particular support is given to the integrated energy strategies implemented by the UAE which address (among other aspects) better demand reduction. Diversifying the nation's energy mix and the adoption of renewable energy sources will collectively ensure a higher level of energy security.

In 2013, the absorption chiller installed at DUBAL became the UAE's first-ever absorption chiller set up in a power plant using excess heat to produce chilled water for comfort cooling. Installed on the rooftop of the DUBAL desalination plant control building, the absorption chiller has replaced the electrically driven vapour compression chillers used previously and consumes less than one tonne per hour of steam. The absorption chiller has been proven to reduce the site's energy consumption by approximately 780,000kWh per year, and also reduced DUBAL's carbon footprint. This has attracted the interest of Dubai Municipality, which is exploring ways of using this technology more broadly.





EGA's renewable energy efforts to-date have included DUBAL's investment of 20 million UAE dirhams in the Mohammed bin Rashid Al Maktoum Solar Park (Dubai) Phase I (13 MW)



EGA's renewable energy efforts to-date have included DUBAL's investment of AED 20 million in the Mohammed bin Rashid Al Maktoum Solar Park (Dubai) Phase I (13MW); participating in a feasibility study relating to the establishment of clean coal-fired power stations in the UAE; and building a mini solar field at DUBAL (70kW). Under the sponsorship of the Executive Affairs Authority in Abu Dhabi, EMAL is working closely with TRANSCO and ADWEA to optimise gas utilisation within the UAE. Several initiatives that will contribute towards establishing a more efficient grid are at various stages of implementation.

EGA's commitment to the responsible use of energy, both through efficient power station operations and other energy-conservation efforts, exemplifies its status as one of the flagship industries of the UAE. The only player in the nation's primary aluminium sector, EGA has not only played a key role in the economic diversification aspirations of the nation, but has also been a pioneer of sustainable development. An ongoing quest for safety first complemented by an unwavering commitment to protect the environment, is fundamental to decision-making and underscores EGA's vision "to provide the global economy with sustainable material of the highest quality, building a legacy of excellence for the UAE and the world." ■

## ABOUT H.E. ABDULLA KALBAN



H.E. is the MD and CEO of Emirates Global Aluminium, a UAE-based aluminium conglomerate with interests in primary aluminium smelting and upstream raw material production. A BSc graduate in Industrial Engineering, he is also inter alia a director of the Federal Electricity and Water Authority and serves on the UAE Supreme Energy Council.

# POWERING COMPETITIVE INDUSTRY

## THE CASE FOR STIMULATING INNOVATION AND CREATING NEW BUSINESS OPPORTUNITIES IN CLEAN ENERGY

Sustainable Energy is described by the Secretary General of the UN as “the golden thread that connects economic growth, increased social equity and an environment that allows the world to thrive.” Indeed the potential of low-carbon growth has been ingrained in the post-2015 sustainable development and climate action agenda through Goal number 7, which aims to “ensure access to affordable, sustainable, reliable and modern energy services for all.” Accelerated action on the ground is needed to achieve these goals by 2030, requiring a concerted effort by key stakeholders in the public and private sectors.



ARTICLE

By Dr.  
Pradeep Monga

The industrial sector is a significant consumer of energy at the aggregate global level, accounting for 40% of final energy demand (Global Energy Outlook 2014). Current forecasts show that industry will continue to be one of the major final energy-consuming sectors in the future and that its share of energy demand will grow by 1.3% per year between 2015 and 2040. Demand for energy-use in the industrial sector over the next two decades is expected to rise at rates higher than in the transport and building sectors because of its potential to contribute to higher economic growth and job opportunities.

To meet the growing demand for energy in the industrial sector, there is a strong need to stimulate the market to improve energy efficiency and promote renewable-energy and low-carbon technologies. Doing so requires intervention to promote the use of sustainable-energy technologies and services and simultaneously ensure their quality and availability in the market. This can be attained through strengthening policy and regulatory frameworks, capacity building and the widespread dissemination of best available practices and technologies in each of these areas. Providing strategic solutions for sustainable-energy challenges by working on these three levels will create further opportunities for new businesses that respond to consumers in renewable energy and energy efficiency. As a result, a sustainable-energy ecosystem may be fostered in the long term, incorporating economic, social and environmental benefits for our booming energy future.

Innovation is a precursor to economic growth and development, fuelling productivity, enterprise creation and employment. Nurturing innovation in sustainable energy can unpack the vast potential of entrepreneurship and research in this area, which shows unprecedented growth potential. Small- and medium-sized enterprises in particular tend to foster innovation and should be empowered through strategic partnerships, technology transfer and facilitation of access to capital. Only then can an ecosystem for sustainable growth be achieved in practice. ↗

## 6

The industrial sector is a significant consumer of energy at the aggregate global level, accounting for about 40% of the total energy demand in 2014; This demand is expected to rise at rates higher than in the transport and building sectors



## Energy Efficiency as a Value Proposition

The adoption of energy-management systems and system optimisation has repeatedly demonstrated effectiveness in increasing industrial competitiveness and productivity. These benefits go far beyond cost reduction and lower energy bills to provide advantages at the societal level in the form of job creation, better economic growth, reduced environmental impacts from energy production and use, enhanced energy security, improved water efficiency and better worker health and safety. Further spin-offs at the individual enterprise level, such as improved operational efficiencies and productivity, reduced material losses and less solid waste are also commonly reported following the adoption of energy-efficiency practices. In UNIDO's experience, such benefits have the potential to add a further 50% in economic gains, in addition to direct energy cost reductions.

Once companies start seeing the significance of energy efficiency as a value proposition, it becomes a game-changer and a trigger for the wide-scale adoption of energy-management systems across the industrial sector. At present, internal decision-making processes surrounding investments in energy management tend to be diffused among different business functions. Furthermore, energy-management projects often compete with those related to quality, production and environmental and safety mandates. The prioritisation of energy management in such an environment requires the incorporation of value-added chains, knowledge management and capacity building to ensure that the potential benefits are well-known and that the commitment of top-level management is secured. In the case of ArcelorMittal's Saldanha Works Plant in South Africa, high-level commitment resulted in investments of USD 50,000, which in turn led to savings of a remarkable USD 9 million in the first year of implementation of the UNIDO Energy Management System (EnMS) programme.

The UNIDO EnMS programme is designed to create technical capacities among key energy users, including consultants and plant personnel working on energy efficiency. In addition to empowering existing energy users and decision-makers, the programme creates new job opportunities through the creation of demand for energy-efficiency services, which in turn stimulates the domestic market for energy-efficiency services. Ultimately, the EnMS programme may transform the market for innovative industrial energy-efficiency technologies and services tailored to local needs. Coupled with an enabling policy environment, building the knowledge and skills of energy managers and demonstrating the potential gains, industrial energy efficiency allows for the creation of new businesses and jobs and the eventual achievement of a self-sustaining market for sustainable energy.

**In the case of Arcelor Mittal's Saldanha Works Plant (...) high-level commitment resulted in investments of USD 50,000, which in turn led to savings of a remarkable USD 9 million in the first year**



## Renewable Energy for Productive Uses

The use of energy from renewable sources provides industry with the opportunity to address long-term issues of energy security and climate change simultaneously, promoting climate-resilient industries and new business models. An estimated 80% of the world's energy demand could be met by renewables by 2050, resulting in a reduction in CO<sub>2</sub> emissions of over 200 billion tonnes between 2010 and 2050 (IPCC, 2011). Only 2.5% of this potential has been tapped at present, leaving room for renewable energies to be adopted in industrial applications for the benefit of people and enterprises.

Promoting fuel switching from fossil fuels to renewable-energy sources increases industrial competitiveness, as companies are less reliant

on volatile energy prices and supply. Furthermore, it creates business opportunities, as energy generated may be sold, providing additional revenues. A recent UNIDO Green Growth Institute study shows that new investments in the clean-energy industry create more jobs than investments in the conventional fossil-fuel industry (UNIDO-GGGI 2015). The case for fuel switching is particularly strong with recent developments in the United Arab Emirates, lead by the Emirate of Dubai. With a regulatory framework that allows for individual connection to the grid from private sources and a record low price per kilowatt-hour for solar energy, Dubai has laid the foundation for an enabling environment for renewables, from which other Emirates may benefit. This model would

be particularly beneficial in the Northern Emirates, which are currently susceptible to price volatility due to reliance on gas and diesel. They would be more resilient and independent in the long term if empowered through price-competitive low-carbon technologies.

The key barrier to the adoption of renewable-energy technologies at present is the lack of awareness of its benefits and an overestimation of the associated risks. There is therefore a strong need to develop the technical capacity and business skills of industry leaders to encourage entrepreneurship in this domain, building a culture of sustainable energy. Moreover, the multiple benefits of innovative multipurpose uses of solar thermal energy in particular

should be demonstrated to promote market-based developments for heating and cooling applications, among others. This includes air conditioning and hot-water production. Strengthening the supply of and demand for quality solar equipment and systems, as well as the vast service sector, generates new businesses and markets for sustainable-energy entrepreneurs.



He is the Director and Special Representative on Energy at the United Nations Industrial Development Organization (UNIDO). An energy expert with over 30 years of experience, his primary responsibility is to provide strategic policy advice to UNIDO member states on sustainable energy and industrial issues. He leads an interdisciplinary team of energy experts, planners and networks of international energy technology centres to promote technical cooperation projects and partnerships in the field of energy efficiency, renewable energy and low-carbon technologies.

ABOUT  
**DR. PRADEEP MONGA**



An estimated 80% of the world's energy demand could be met by renewables by 2050

## Fostering Innovation in Sustainable Energy

By fostering innovation in the area of sustainable energy, we can realise aspirations for economic growth, while transforming the market to a more sustainable means of operation. This will ultimately transform lives, both in the present and the future. With myriad benefits and minimal investments, the case for switching to clean energy has never been stronger and the possibilities for innovation never vaster. Fostering innovation in clean energy is key to achieving inclusive and sustainable industrialisation and to create a world of economic, social and environmental opportunity. ■

6

Terminal 3 in Jebel Ali will be amongst the world's largest semi-automated terminals, with 19 energy-efficient quay cranes operated remotely



# FOREVER GREEN

## DP WORLD'S ENERGY MANAGEMENT INITIATIVE

In the drive towards a green economy, DP World launched an energy-management programme across its portfolio of 65 marine terminals, to raise awareness and change behaviour across a 36,000-employee business that impacts millions through the global supply chain.



By  
Nabil Battal



The programme began with the idea of transitioning from CO<sub>2</sub>e to energy, with the target of a 27% reduction of normalised\* CO<sub>2</sub>e emissions over a five-year period beginning 2008. Some 98% of carbon emissions at terminals are generated from diesel combustion and electricity consumption and the programme aims to implement energy-reduction strategies that cut operational spending and slash CO<sub>2</sub>e levels.



In developing energy-management initiatives, monitoring is essential. An energy-reporting tool was introduced to measure diesel and electricity consumption levels and allow for comparisons of terminals' individual environmental impacts. Using the same energy-reduction elements across units allows large-scale multinationals to compensate for variances in regulatory frameworks between countries and normalise emission reporting against total modified Twenty Foot Equivalent (TEU) volume. This results in a broad account of energy use, rather than identifying where and how waste occurs, so the Global Safety and Environment Department instead compared energy consumption with Total Terminal Moves (TTM) for a clearer picture, focusing on comparing terminals with the same modes of operation. Additionally, an energy assessment programme was launched with desktop and on-site energy assessments, focusing on the inspection and analysis of energy flows, while looking for opportunities to reduce energy usage without impacting productivity.



## Energy Experts

This project, led by a dedicated energy management team supported by environmental and operational specialists, initially saw business units commit to sharing best-practice initiatives. In 2014, two thirds of business units were allocated targeted energy-reduction plans.

To compare programmes, an Opportunity Evaluation Matrix was also developed rating each opportunity according to potential savings. Metrics include savings, costs, simple payback, estimated implementation time and the level of project management required. The total value is plugged into the matrix to determine viability. 

## ENERGY Saving opportunity evaluation matrix

### Immediate:

department level signoff, typically smaller savings at little or no cost

1	3	6	10	15
2	5	9	14	19
4	8	13	18	22
7	12	17	21	24
11	16	20	23	25

### Prioritise:

terminal level sign-off, typically good savings with favourable returns on investment (ROIs)

### Plan and Budget:

a good project with acceptable return on investment that requires a level of planning and budgeting and should be scheduled for completion in the medium term

### Monitor:

a project that has potential if certain variables change; this could be an increase in volumes or reduction in costs as technology develops

### Not Viable:

a project that is unsuitable for a specific terminal due to a multitude of constraints



In 2014, two thirds of business units were allocated targeted energy-reduction plans

## ABOUT NABIL BATTAL



He has multi-sector experience and has a track record in achievements within Safety & Environment through ingraining a culture of continuous improvement. His key skills are the design and implementation of corporate strategy, supported by behavioural leadership programmes and robust governance systems.



## Energy Efficiency and Renewable Energy:



Throughout 2014, we made substantial progress in developing state-of-the-art equipment and upgrading terminals. In Australia, we established an advanced semi-automated terminal at the Port of Brisbane, improving safety and productivity while reducing energy use. In the UK, we launched berths designed to handle the world's largest vessels quickly and efficiently at DP World London Gateway and Southampton. Meanwhile, Terminal 3 in Jebel Ali will be amongst the world's largest semi-automated terminals, with 19 energy-efficient quay cranes operated remotely.

In 2014, we also conducted six feasibility studies into alternative-energy options, exploring the potential of alternative fuels across the operational fleet. In Pusan, South Korea, we trialled conversion of a diesel yard tractor to Liquefied Natural Gas (LNG), which resulted in significant savings and a reduction in CO<sub>2</sub>e emissions. The Pusan terminal will install an LNG fuel station and convert 35 vehicles to LNG by year's end.

These processes have enabled DP World to communicate the value of sustainable growth and achieve reductions in the CO<sub>2</sub>e intensity target by 3% in 2014, against the 2013 base year, with measures that can be applied across geographical and cultural boundaries.

Normalised CO<sub>2</sub> emissions are the sum of direct and indirect emissions measured against the total volume of containers (TEU's) moved across DP World's global network. ■

# POWERING RENEWABLE ENERGY WORLDWIDE

IRENA AND ADFD ARE FINANCING RENEWABLE ENERGY PROJECTS IN DEVELOPING COUNTRIES.



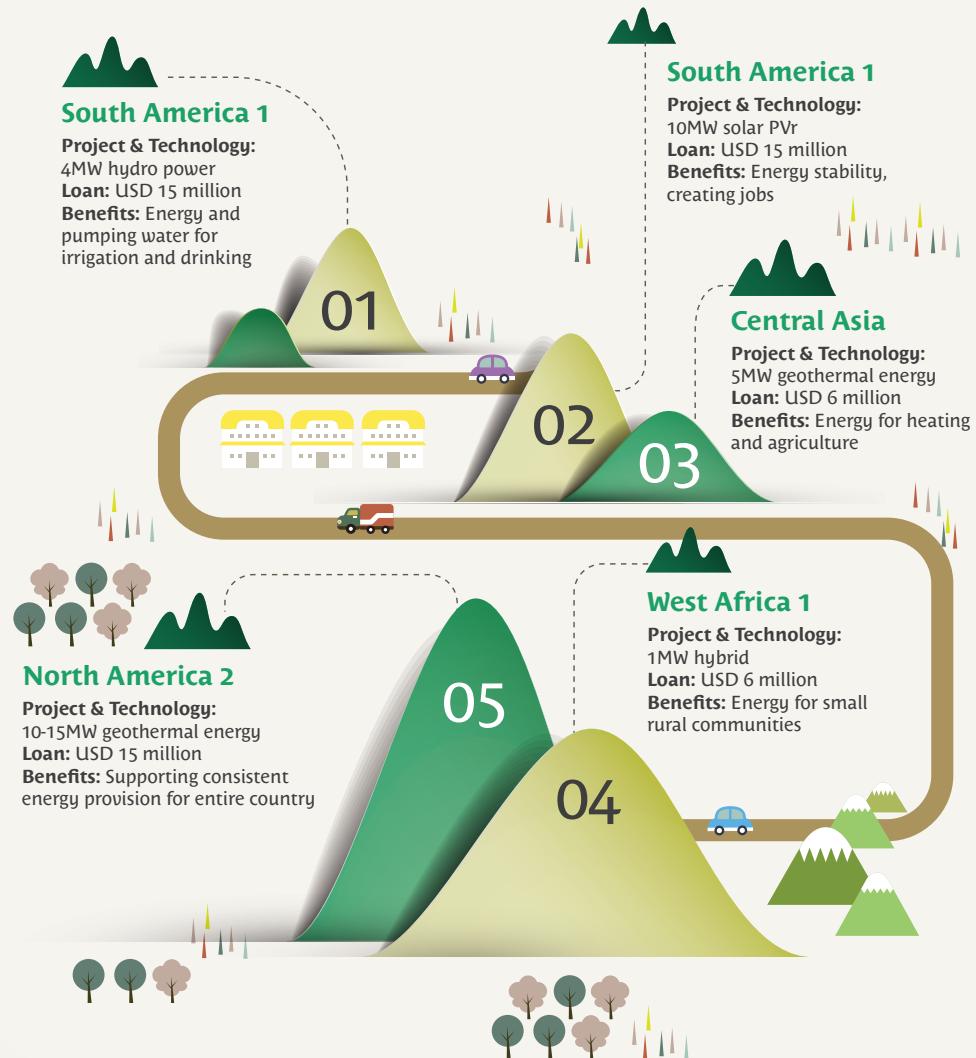
By  
Seleha Lockwood



**The Project Facility has already allocated USD 100 million in funding over its first two cycles**

Financing is one of the biggest challenges when it comes to increasing renewable-energy deployment across the globe. Many developing countries, for instance, have vast renewable energy potential with significant development benefits, but have capital constraints and a lack of access to attractive long term finance. This is not because the projects are not promising, but rather, is due to the perceived risks surrounding rapidly evolving technologies or unfamiliar approaches to energy provision.

## Second-cycle projects receiving USD 57 million in loans



One of the ways the International Renewable Energy Agency (IRENA), in cooperation with the Abu Dhabi Fund for Development (ADFD), is seeking to address this financing gap is through the IRENA/ADFD Project Facility. The Project Facility aims to advance renewable energy and drive the global energy transition through innovative, replicable and sustainable development projects. Public development funds at the global, regional and national level provide vital momentum for key projects, which can then

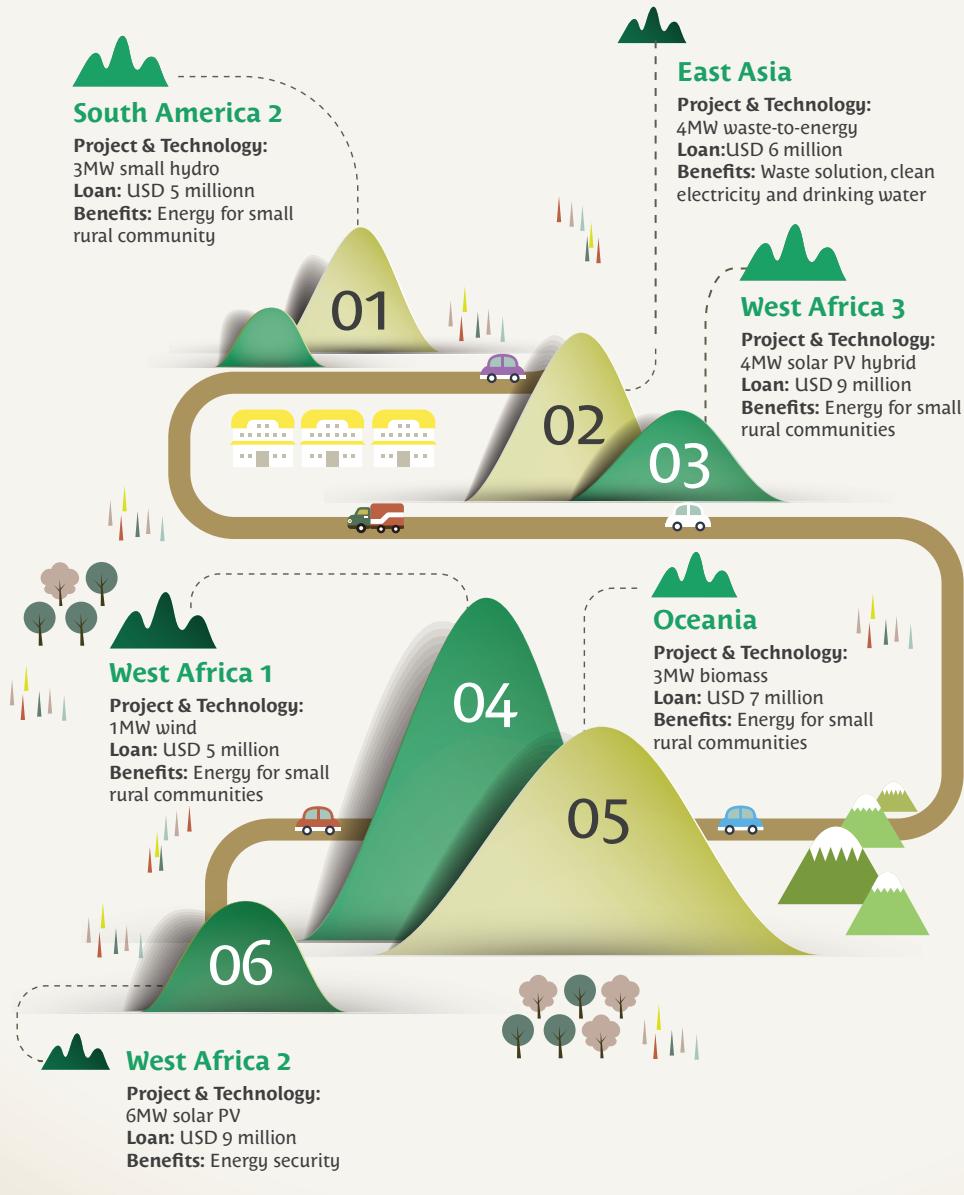
supply sustainable energy to communities lacking adequate access and create replicable models with strong economic and social development benefits for others to follow.

The Project Facility has already allocated USD 100 million in funding over its first two cycles, which has leveraged an additional USD 128 million from other funding sources. The Facility will provide an additional USD 250 million throughout its remaining five cycles through

concessional loans with interest rates of only 1-2%.

Projects approved for funding to date include solar, hydropower, geothermal, biomass, wind energy and hybrid projects in Central Asia, East Asia, North America, South America, West Africa and Oceania. These projects will improve energy access for more than half a million people in developing countries and bring 56 megawatts of renewable-energy capacity online.

## First-cycle projects receiving USD 41 million in loans



Selected projects must be technically and economically feasible and must address energy security by diversifying the energy supply, saving energy resources or reducing grid outages. The projects should also benefit society by delivering access to clean energy, providing new connections to the grid or adding megawatts to the power supply.

The projects identified for funding in the first two rounds of the IRENA/ADFD project facility are shown

above. Co-financing for these projects comes mainly from the government itself but also from other multilateral, regional and bilateral funds.

Each cycle, including the third currently in process, has received many more applications than can be funded, which confirms there is a large appetite for and desire to implement renewable-energy projects around the world.

Renewable energy offers the prospect of clean, affordable power to the more than one

billion people currently off the electricity grid. While renewable-energy resources are abundant in many communities suffering from energy poverty, finance is still a key challenge for deployment. This is why the partnership between IRENA and ADFD is so important as a pioneering effort. ■

## ABOUT SELEHA LOCKWOOD



She is a Programme Officer at IRENA Knowledge, Policy and Finance. She has managed the IRENA/Abu Dhabi Fund for Development (ADFD) project facility ([www.irena.org/adfd](http://www.irena.org/adfd)) since joining the agency in 2012. She ensures the Facility meets IRENA's objectives in the selection of renewable-energy projects in developing countries for funding by ADFD. She has over 20 years of project management experience in industry, government and NGOs covering sustainable development, greenhouse gas emission mitigation, renewable energy and energy efficiency.



Find out more about the IRENA/ADFD Project Facility

The fourth cycle will open for applications for funding in mid-November 2015.

For more details visit:  
[www.irena.org/adfd](http://www.irena.org/adfd)

# IDENTIFYING BEST PRACTICES THROUGH THE GHG INVENTORY



By Eng. Meshayel  
Omran Lehsson &  
Eng. Reshma Francy



The Greenhouse Gas (GHG) emissions of a country arise from various activities, including electricity generation, road transportation, waste decomposition and diverse industrial activities. The Ministry of Energy has undertaken the task of estimating the UAE's GHG emissions – specifically carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride. The UAE GHG Inventory is a multi-stakeholder initiative and the success of the inventory is solely dependent on cooperation from the various entities in the country.

One such entity is EGA, which has provided continuous support and prompt responses to data requests for the UAE GHG Inventory Project. While reviewing the process-related emission estimates for aluminum smelting, substantial emission reduction of perfluorocarbons (PFCs) was observed. PFC emissions have a Global Warming Potential (GWP) in the range of 7,390 to 12,200. This implies that 1 tonne of PFC emitted is equivalent to 7,390 to 12,200 tonnes of CO<sub>2</sub>. Therefore, even small volumes of PFC emissions make large contributions to the national inventory and thus to climate change.

Aluminium smelting uses electrolysis to reduce alumina ore to aluminium. Should the alumina content fall below the critical level required for the electrolysis process, rapid voltage increases occur (termed "anode effects"). The anode effect leads to carbon from the anode combining with the fluoride in the electrolysis bath, resulting in PFCs – specifically CF<sub>4</sub> and C<sub>2</sub>F<sub>6</sub>. The amount of PFCs emitted in aluminum smelting depends on the frequency and duration of these anode effects. Managing these factors depends primarily on the pot technology and operating procedures. EGA Jebel Ali has pioneered the development of reduction technologies through in-house efforts, resulting in proprietary reduction technologies which are energy efficient and deliver lower emission intensity. At the same time, the stringent operating procedures and best practices followed have ensured a significant drop in the volume of PFCs emitted per tonne of aluminum produced by EGA Jebel Ali.

The reduction technologies used at EGA Jebel Ali fall into two categories: CWPB Center-Worked Prebake (CWPB); and Centre work pre-bake cell technology with point feeder (PFPB). The breakdown of the technologies is shown in Table 1.



UNITED ARAB EMIRATES  
MINISTRY OF ENERGY

## ABOUT ENG. MESHAYEL OMRAN LEHSSONI



She is the Acting Director for Clean Energy and Climate Change department, Ministry of Energy, UAE. She joined the Ministry of Energy in 2013. She is responsible for the department of Clean Energy and Climate Change activates, including the preparation of the fourth national communication report for the UAE to be submitted to the United Nations Framework Convention on Climate Change and the Greenhouse Gas Inventory of the United Arab Emirates.

## ABOUT ENG. RESHMA FRANCY



She is a Senior Climate Change Engineer, Ministry of Energy. She holds a Master of Science in Engineering Systems and Management from the Masdar Institute and has worked in the field of climate change since her graduation. Her experience includes the IPCC GHG inventory methodologies, policy and strategy development and clean development mechanisms.

**Table 1: List of Technologies Deployed at EGA Jebel Ali**

In the CWPB category, the CO<sub>2</sub> equivalent emission intensity

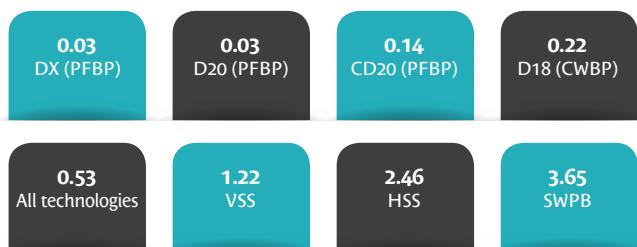
Technology Category	CWPB	PFPB	PFPB	PFPB
Cell Technology	D-18	CD-20	D-20	DX
Feed Type	BF	PF	PF	PF

is almost on par with the global average for the same type of technology. However, for the PFPB category the cell technologies at EGA Jebel Ali have a PFC emission intensity which is lower than the world average for the same technology type.

### Comparing each EGA-Jebel Ali Technology with World Mean PFC emission intensity



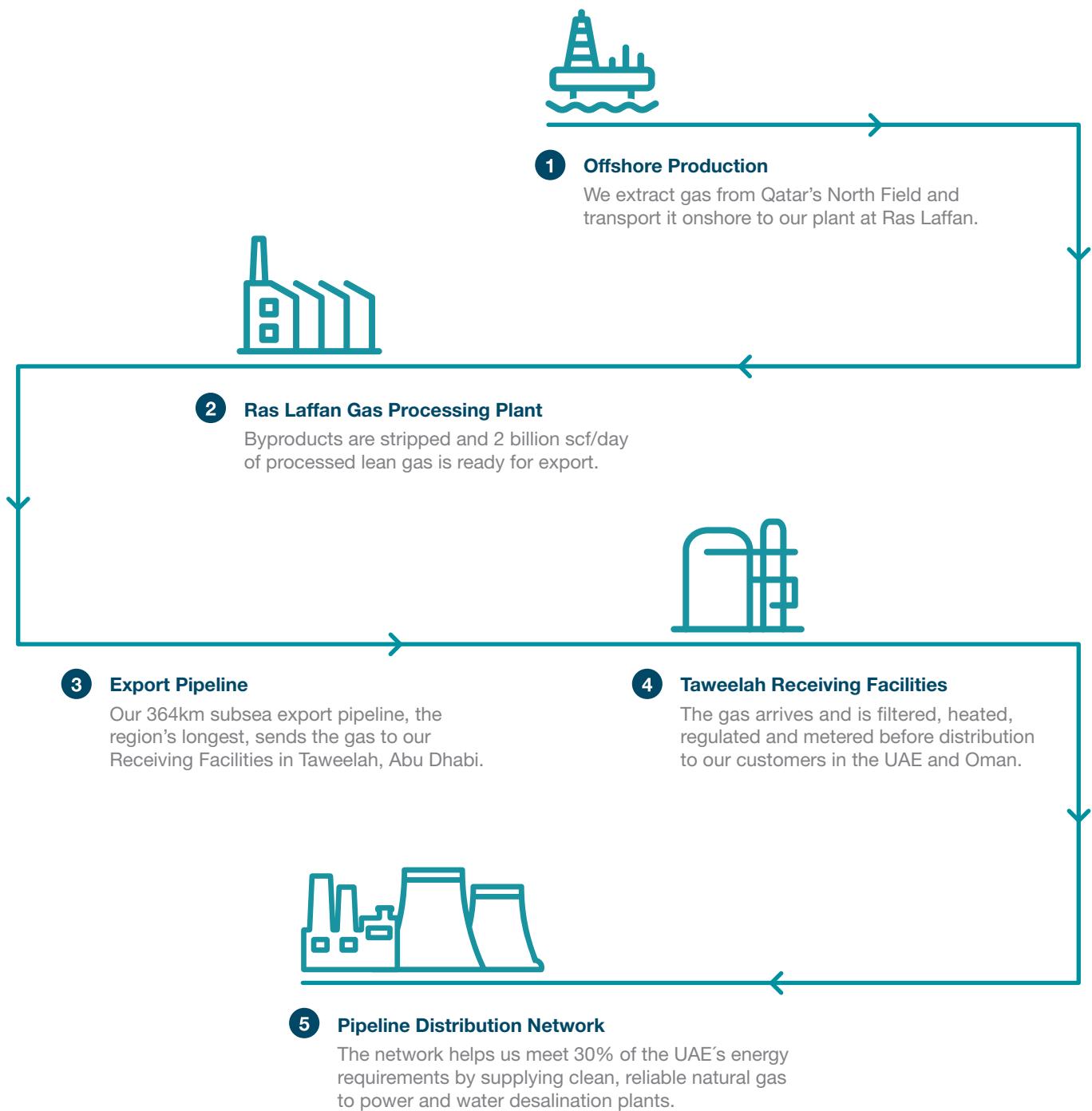
### Comparing EGA-Jebel Ali Technology PFC emission intensity to other technologies



Moreover, when compared to the world average for other technology categories – such as Side-Worked Prebake (SWPB), Horizontal Stud Soderberg (HSS) and Vertical Stud Soderberg (VSS) – the PFC emission intensity at EGA Jebel Ali is significantly lower.

Similar success stories within the UAE have come to light through wide stakeholder engagement and review of the data submitted as part of the UAE GHG Inventory initiative. Also, as we progress through an update of the UAE GHG Inventory, the various data gaps are reduced and more accurate numbers become available. Through the compilation of the UAE GHG inventory, various energy efficiency and process improvements will be captured and represented in quantitative form to establish the success of the UAE's sustainable development programmes.

# The Dolphin Gas Project is one of the largest energy-related business ventures in the Middle East, and the region's only trilateral gas grid.



# COMPETENT EMPLOYEES



By Dr. Eng.  
Waddah S. Ghanem  
Al Hashimi & Eng. P.  
Radhakrishnan



ARTICLE

## A KEY TOOL IN ENERGY RISK MANAGEMENT

ENOC, operating in the high risk oil and gas sector, has always considered competent employees as a key component in risk management. ENOC believes in promoting a structured approach to any undertaking, including training and competency.

The oil and gas sector faces a challenge with the shortage of talent. The industry is scrambling to keep up, as education efforts serve only to bring in new and inexperienced employees. It is difficult to find candidates with 5-10 years' experience within the sector. This shortage, combined with the volume of employees reaching retirement age, creates a talent shortage that spans the entire energy industry.

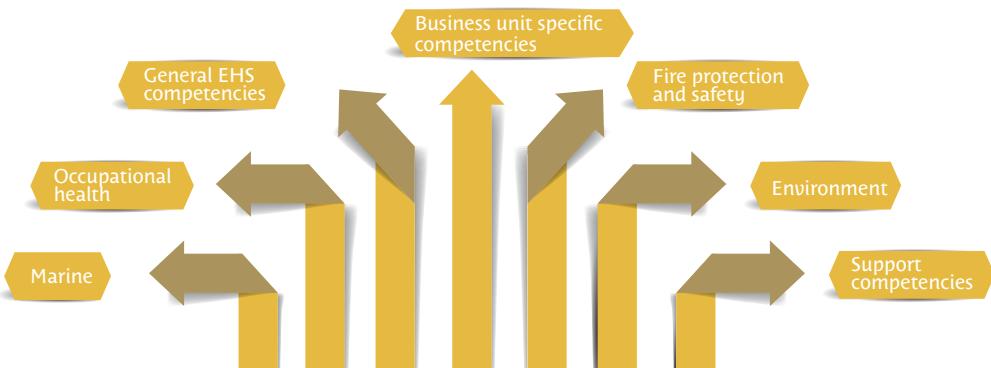
To overcome this challenge, ENOC has implemented a competency matrix to evaluate the requirements involved in finding the right talent, customising training programmes by developing skills internally and attracting skilled professionals from emerging markets to create work efficiency within the organisation. This serves as a case study for the energy industry and may serve as a catalyst to solve some of the competency challenges the industry is facing.

Our structured approach dictated that a manual be developed for ensuring competency. Competency can be a non-tangible element, but over a number of years working closely with departments such as Group Environment, Health & Safety (GEHS), we were able to assemble our learnings in a manual entitled EHS Competency Framework. The broad aim of this manual is:

*"Employees shall receive necessary training to provide the skills for accomplishing their assigned roles and responsibilities. Systems and programmes that support this element include employee selection, identification of employee training and development needs, employee orientation, required regulatory training, development and maintaining of training resources, and demonstration of proficiency."*



Some of the competency requirements covering all areas of EHS are as follows:



The ENOC competency framework consists of a matrix with levels running horizontally and competencies running vertically. The cells within this matrix are populated with the requirements or definitions to achieve a certain level of a competency. The levels run from 1 to 4 with increasing competencies required for higher levels:

## LEVEL 1 Awareness:

Can describe in basic terms a sound understanding and good knowledge of what is involved

## LEVEL 2 Knowledge:

Awareness + able to interpret and evaluate information and advice from experts

## LEVEL 3 Skill:

Knowledge + able to carry out consistently the activities to the required standard

## LEVEL 4 Mastery:

Skill + able to diagnose and resolve significant, unusual problems and to successfully adopt

Energy and Resource Management (E&RM) competency is defined in the manual in levels from awareness, through knowledge and skill, to mastery.

These requirements are essential for developing and implementing an energy-management system, but they are nowhere near sufficient in initiating and implementing conservation measures, which is the ultimate goal. Hence a separate competency matrix is required for key personnel who are responsible for planning, designing and implementing energy-management and conservation projects.

Some key personnel likely to be involved are energy technicians, energy engineers, energy managers and energy executives. The basic job description, in addition to other jobs they may have in the organisation, and the preferred qualifications are provided below. Some degree of overlap between these functions can occur.



FACT BOX

Training and competency is recognised as a key element in ENOC's Competency Manual - EHS Competency Framework. The key objective is:

**"To ensure that personnel are competent to perform their work duties and meet EHS roles and responsibilities."**

## Profiles of some of the key personnel would, on a broad level, be as follows:

### Energy Technicians (Operators):

The energy technician is an operations or maintenance person in the organisation, who has been provided adequate training to achieve the required competencies set out in the competency matrix. In addition to routine jobs in maintenance, utilities or operations, they are expected to ensure that plant and equipment are operated and maintained at optimum levels and efficiencies are not compromised. In order to do this, they are expected to implement work instructions and procedures issued for achieving optimum operating conditions. They are also responsible for reporting any deviations in instructions, procedures or operating conditions to seniors for implementing corrective actions.

### Energy Engineers (Designers/Reviewers):

The energy engineer is primarily a hands-on operational or maintenance position. They are expected to study the operations, processes and maintenance operations and identify areas where savings in energy and resource-use can be achieved. They do this through measuring, monitoring, data acquisition and analysis and comparison with benchmarks and norms. They are also responsible for setting operational criteria for E&R efficiency, developing targeted maintenance programmes to ensure the continuing efficiency of plant and equipment and training technicians and operators in energy efficiency and efficient operations.

### Energy Managers (Executives):

The energy manager is the key person within the organisation for energy and resource performance improvement activities. They are the leader within the organisation in regards to spearheading and directing improvement activities. They are expected to advise top management on policy, objectives and targets and resources required for implementing improvement projects. They are responsible for monitoring progress, auditing systems and reporting results to top management while advising on the way forward.

### Energy Executives (Policy Setters):

The energy executive is a member of the top management of the organisation. They are expected to set policies, review and approve objectives and targets and make resources available for developing and implementing a robust E&R management system. They are also expected to provide leadership and motivate personnel throughout the organisation to improve E&R use performance. They are expected to regularly communicate the benefits of E&R conservation both within and outside the organisation.

Once the key players in energy management and conservation are identified, competencies and the definition of each level can be developed. Based on this development, 12 competencies can be established.

## Capacity Building & Competency Assurance

- |  |  |  |
|--|--|--|
| <ol style="list-style-type: none"> <li>1 Energy &amp; resource management system standard</li> <li>2 General electricity conservation</li> <li>3 Air conditioning &amp; refrigeration</li> <li>4 Pumps, compressors and motors</li> <li>5 Heating &amp; combustion efficiencies</li> <li>6 Lighting</li> <li>7 Renewable energy</li> <li>8 Management system auditing</li> <li>9 Management system standards</li> <li>10 Energy &amp; resource use monitoring &amp; analysis</li> <li>11 Energy &amp; resource use auditing</li> <li>12 Significant energy &amp; resource use</li> </ol> |  | <ul style="list-style-type: none"> <li>Technician</li> <li>Engineer</li> <li>Manager</li> <li>Executive</li> </ul> |
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### ABOUT DR. ENG. WADDAH S. GHANEM AL HASHIMI



He is the Executive Director – EHSSQ & Corporate Affairs at ENOC. He has a Bachelor's Degree in environmental engineering, an MSc in Environmental Science from UAE University and an Executive MBA and later a DBA from Bradford School of Management, UK. He has co-authored three books on organisational management and holds senior roles in numerous Corporate Affairs and EHSSQ and organisational committees.

### ABOUT ENG. P. RADHAKRISHNAN



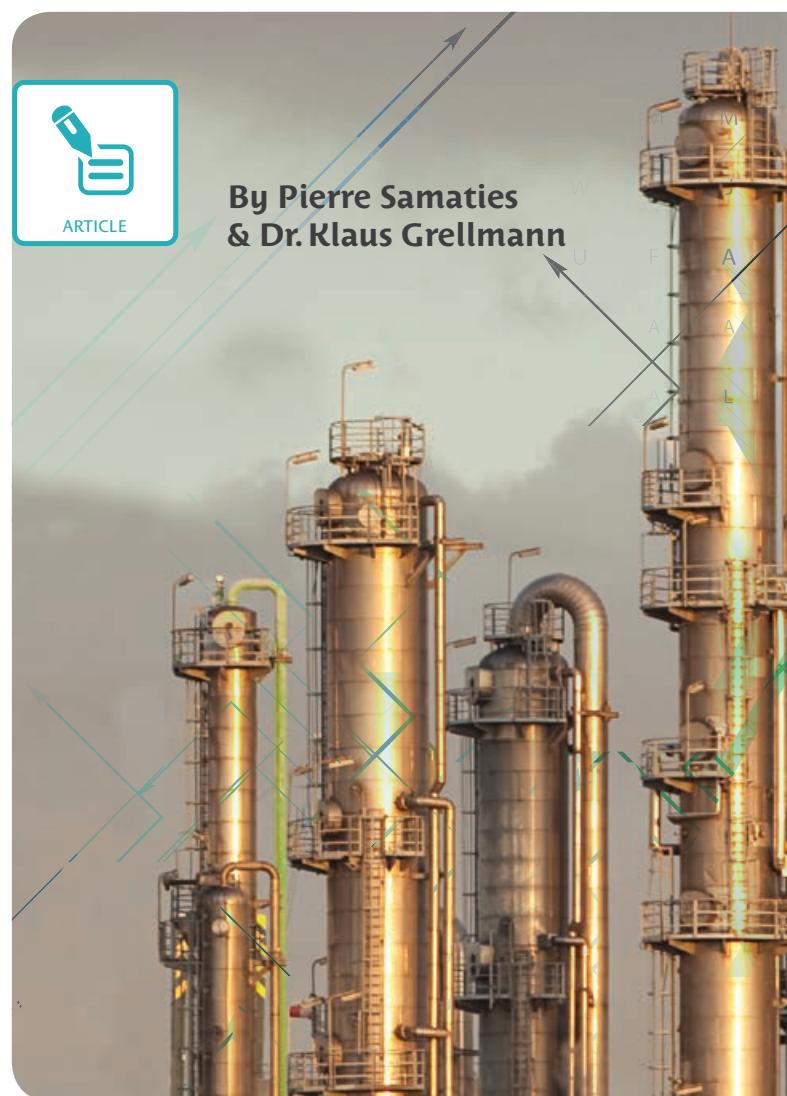
He is Chief EHS Compliance Officer (Environment & Energy) at ENOC. He has a BTech and MS degree in Chemical Engineering. He has over 30 years' experience spanning areas such as research and development, operations, QHSE and energy in manufacturing, chemical, petroleum and power industries.

After competencies are established, the definitions for each competency at a particular level can be developed and the overall energy competency framework developed.

The required competency levels for each of the key players, such as technicians and engineers, can be determined through discussions with business-unit members in the Technical Committee. Once the requirements are finalised, the competency matrix can be developed. ■



By Pierre Samaties  
& Dr. Klaus Grellmann



# BEYOND THE UTILITY

## HOW ENERGY COMPANIES REMAIN HIGH-PERFORMING ENTERPRISES

The energy industry is experiencing radical change. What was once considered a traditional and predictable industry has become one of the most exciting and fast-paced sectors today. There is no doubt that the core of the traditional utility business will continue to exist, but we will be seeing drastic change when it comes to adopting new business models and revenue diversification.

Traditional energy sources are becoming scarcer. Demographic change, striving for more sustainable supply, demand-side management and new technologies are the main game-changers. The traditional boundaries of business models are becoming blurred and are creating new opportunities at the interface of different industries such as smart technology, electric vehicles and big data.

Utility companies around the world are looking for ways to take advantage of these opportunities and are continuously transforming their businesses. Based on our experience with global and regional utilities as well as with RWE's own transformation, we believe that the traditional utility organisations need a set of core competencies in order to capitalise on the future. These include:

An innovation culture that empowers and motivates its employees to contribute to the vision of the company's leadership

**1**

Lean structures and processes and rapid reaction to the new opportunities

**2**

Reward-based performance orientation that aligns key performance indicators of all parts of the organisation to the overarching goals

**3**

Venture management and rapid prototyping

**4**

An aligned and harmonised leadership culture and the elimination of silo-thinking

**5**



In the Middle East, we see a number of initiatives with different utilities heading in this direction. This includes restructuring and strategic transformation programmes (e.g. SEC in Saudi) as well as revenue diversification and innovation (e.g. DEWA with MaiDubai and RWE Middle East), to name just two. From our experience in transforming RWE, we can share specific examples on how to implement the above-mentioned success factors.

### Focus on innovation and venture management:

Innovation at RWE, with a central innovation hub and several pioneering lighthouses such as a Holistic Energy Manager, Big Data, SMART & Connected and Disruptive Digitisation, focuses on business-model innovation and projects enabling RWE to develop faster prototypes and market entries.

RWE is leveraging successful methods and principles for innovation, establishing cross-business partnerships and an external innovation network to accelerate change. In addition, RWE introduced the mindset of rapid prototyping to its corporate culture. Innovation requires a mix of skills, so our Innovation Hub works with multidisciplinary teams and external partners. This gives our most daring, creative and entrepreneurial employees the freedom to explore ideas and develop the best way to move to market maturity.

In addition, RWE – in over 115 years of existence – has always focussed on innovation and ventures. To be ready for the uncertainty of future markets, RWE has diversified by making smaller investments and getting involved (via corporate venture capital) with innovation startups and new ventures that are likely to become profitable businesses in the future (e.g. thin film pv). ◀



**By April 2015 – with two more months planned for workshop cascades – a total of 35,000 employees (nearly 60% of all RWE staff) had already participated**

## Set up lean structures and processes with clear performance orientation – RWE’s “New Ways of Working” programme

RWE's group-wide programme "New Ways of Working" (NWoW), introduced in 2014, is built upon three pillars: Leadership & Direction, End-to-End Processes and Operational Excellence. Over the course of the next three years, these pillars will be implemented across RWE following an integrated approach and a standardised method. This will standardise working practices, extend the skills and capabilities of employees and create a common culture.

NWoW provides transparency and measurability of performance indicators, which employees create and develop themselves. This helps produce structures for continuous improvement and enables us to turn hierarchies upside down.

NWoW strengthens RWE in the dimensions of leadership, employees, customers and financials. In all four dimensions, NWoW is designed to make the group more effective and high performing. These four aspects are all equally important. In order to achieve all four objectives, we are creating structures and establishing a culture of measurable continuous optimisation and improvement.

## “Next level leadership” and “One RWE”

One of the key success factors for companies is to ensure that the leadership philosophy among top executives is harmonised and employees are empowered. In addition, it is crucial to eliminate silo-mentality, i.e. different divisions behaving like separate entities with separate goals. In order to change the corporate culture, RWE's first step towards preparing for change was to align the top leadership team (TOP 300 leaders) on topics such as the strategy and the key initiatives required to transform the business. With initiatives such as the Next Level Leadership Programme, leadership capabilities within RWE will be further enhanced.

By improving our leadership culture we can achieve much higher levels of employee satisfaction. Satisfied and high-performing employees form the basis of a high level of customer satisfaction. An integral part of this change process was to fully integrate all employees into the company. With this aim in mind, an initiative called "We are RWE" was launched in 2014 to not only reach the leadership, but the mass of employees throughout Europe. By April 2015 – with two more months planned for workshop cascades – a total of 35,000 employees (nearly 60% of all RWE staff) had already participated.

The adaptation and implementation of these success factors will influence who will win the race for excellence in the Middle East energy industry in the long-term. We are confident that these companies will have a bright future as we see great commitment levels and visionary leadership in the regional energy sector. ■

### ABOUT PIERRE SAMATIES



He is the Chief Executive Officer of RWE Middle East. RWE Middle East is a leading advisor for the Middle East's energy industry focusing on strategy, innovation and ventures. Pierre has extensive experience in the energy and management consulting business. Before assuming his current role, Pierre was Partner at RWE's consulting business in Europe where he advised clients in the energy industry on business strategies, transformations and new ventures.



RWE introduced the mind-set of “rapid-prototyping” to its corporate culture

### ABOUT DR. KLAUS GRELLMANN



He is the Chief Executive Officer of RWE Consulting and Member of the Board of Directors of RWE Middle East. Before leading the international consulting business, Klaus was Executive Vice President Strategic Planning of the RWE Group from 2003 – 2006. Prior to his career with the RWE Group, he was a senior manager and authorised representative for PricewaterhouseCoopers in Berlin and Houston.



it is crucial to eliminate silo-mentality, i.e. different divisions behaving like separate entities with separate goals

# ENERGY-SERV AND THERMA CHEM

## THERMA CHEM FS-12



By  
**Catalin Dragostin**

Therma Chem FS-12 is a chemical designed for application in process heaters and boilers that utilise fossil fuel and fuel derivatives. These fuels contain impurities, which are not completely burned off in the firing process, creating slag or ash, which sticks to the heat-exchange surfaces, forming a restrictive thermal barrier. This thermal barrier, commonly referred to as fireside slagging, ash fouling or deposits, can represent a significant challenge for the equipment and its operation, resulting in increased fuel consumption, reduced production outputs, corrosion and in severe cases, unit shut-downs for manual cleaning.

The chemical attacks, removes and prevents the deposits that lead to efficiency losses. It reduces cleaning requirements of the equipment and at the same time eliminates low-temperature acid corrosion, vanadium corrosion and high-temperature corrosion, which has a positive effect on the lifetime of the unit.

The chemical fireside on-line treatment technology is of British origin, manufactured in accordance with EU standards, and has been in the market for more than 25 years. It is certified as an environmentally friendly product.

The chemical offers a low-cost measure for reducing greenhouse-gas emissions, increasing energy efficiency and even restoring capacities that have been lost due to the decay of equipment.

The chemical has been successfully utilised in the Holboaca CET Iasi II combined heat and power plant in Romania under the UNFCCC backed Joint Implementation mechanism, resulting in fuel savings and associated annual emission reductions in excess of 30,000 tCO<sub>2</sub>/year.

Currently, Saudi-based utility company Saline Water Conversion Corporation is looking into possibilities to develop a Clean Development Mechanism (CDM) PoA under the UNFCCC framework for the utilisation of FS-12 in their power and desalination plants. A new CDM methodology has been developed for this type of CDM activity. ■



Energy-Serv is a Romanian ESCO-type company (Energy saving company) with many years of experience in renewable energies and energy-efficiency solutions within the power and oil and gas sector. Energy-Serv has been active in the Middle-East since the '90s with the distribution of Therma-Chem FS-12 (FS-12), a fireside cleaning technology for boilers and process heaters resulting in capacity restoration, efficiency increases and reductions in fuel consumption and greenhouse-gas emissions.

### ABOUT **CATALIN DRAGOSTIN**



He is Managing Director of Energy-Serve, the first private Romanian ESCO-type company, established back in 1996. He is a graduate of Nuclear Power Engineering University in Romania, has a background and experience of Power utility business. Before setting-up Energy-Serv in 1996, he has worked for former Romanian utility company RENEL, a vertically integrated power company.

# VOLATILITY AND THE WAY OUT

## FOCUSING ON THE NEW RISKS TO BUILD RESILIENT ENERGY INFRASTRUCTURE



The past year has seen a dramatic drop in the price of oil, which has sent shockwaves through the entire energy sector. Volatility is the new normal, and, for a sector known for its conservative outlook, this drives those at the forefront of the energy challenge to re-evaluate conventional wisdom. We can see that it is not just price shocks that keep energy leaders awake at night. Hurricane Sandy in 2012, the hydro shortage in Brazil in 2014 and the increasing cyber attacks across industries are important wake-up calls for energy leaders globally when it comes to the resilience of our energy systems. Yet, resilience is just one aspect of a much more fundamental transformation of the energy system.

By  
Dr. Christoph Frei



The energy industry itself is in transition and the shift to new lower-carbon energy systems must be done in a way that is both cost-effective and reliable. Meanwhile, growing renewable shares with zero marginal costs call into question current market design. Energy markets are often based on marginal costs, as capital costs are difficult, if not impossible, to cover and such incentives fail to properly incentivise storage or back-up capacity. Resilient approaches to managing emerging risks must ensure that the future infrastructure is fit for a changing risk landscape.

Resilience as a concept can be framed as ambition in how the best boardrooms respond to this changing risk landscape and global economic uncertainty. Resilience first requires an overview of relevant emerging risks as well as a thorough understanding and assessment of the individual risks and their systemic relevance. With increasingly interconnected and co-dependent systems, what happens in seemingly unrelated processes can have far-reaching consequences. In nature, we had to learn that a monoculture can be paradise for a quick spreading pest – on the energy technology side, we are still in the stage of building up what may look like a monoculture of normed and normalised systems.



**looking through a ‘resilience lens’, the diversification of energy sources and technologies and the concept of a low-carbon economy can be viewed as an opportunity**

The World Energy Council, as the largest global network of energy leaders and practitioners, has identified five emerging risk categories that are of utmost concern to its community: water stress and the energy-water-food nexus, extreme weather events, cyber threats, social activism and technology efficacy.

Embedding the concept of resilience within energy decision-making is of increasing importance in all parts of the world, yet with different priorities in each region. We see extreme weather events or the energy-water nexus as being high on the list of concerns in Asia, the Americas and the Middle East, while cyber threats are more prominent concerns in Europe and North America. Addressing these issues requires an understanding of the facts in terms of changing severity, frequency, or exposure to these risks and an assessment of infrastructure and system design implications, backed by adequate financing and insurance models. Providing for secure, accessible and environmentally sensitive energy systems - what we at the World Energy Council call “The Energy Trilemma” - can only be met in the future if we plan for and build the adequate infrastructure that responds to these challenges now.

When looking through a resilience lens, the diversification of energy sources and technologies and the concept of a low-carbon economy can be viewed as an opportunity for countries directly exposed to some of these risks. For example, GCC member states may well have the ambition to position themselves as leading innovation with regards to the energy-water-nexus or cyber risks.

The Middle Eastern region, with its growing population, increasing energy and water demands, and decreasing freshwater supplies, is becoming increasingly vulnerable to the challenges that the energy-water-food nexus presents. The region also witnessed important cyber attacks and has critical infrastructure that is vulnerable to such attacks.

Resilience is not a product, but a process; not a destination, but a journey. Any energy system plan or strategy must consider resilience at its core. It is therefore important that policymakers across sectors work together, considering the needs of new technologies and risk-mitigation approaches. ■

## ABOUT DR. CHRISTOPH FREI



As Secretary General of the World Energy Council his priorities have been to mobilise international energy leaders and decision-makers to work together towards building a sustainable future and provide them with the necessary evidence base and high-level dialogue platform for robust policymaking to address the “energy trilemma”.

# FINE TUNING PROCUREMENT

## SUSTAINABLE PROCUREMENT GUIDELINES ENSURE BEST-IN-CLASS EQUIPMENT

**Priyalal Liyanage – Procurement & Contracts Department (P&C) – ENOC explains ENOC's comprehensive procurement process in ensuring that best-in-class equipment is in place for the efficient management of resources across the company's operations.**

Sustainable procurement is a huge part of ensuring the success of ENOC's energy and resource management (E&RM) strategy. As a high profile matter in businesses today, it can help save money, reduce waste, improve competitiveness and solidify ENOC's reputation as an exemplary sustainable and responsible oil and gas company.

The standard procurement process at ENOC was established in January 2013 and aligns with ENOC's E&RM policies within a smooth timeline. The process for procuring any energy-efficient product or service begins with procurement and contracts (P&C) drafting a list of suppliers interested in bidding for a particular contract. Once the end-user and EHS team prequalify the bidders, the contracts are outlined, negotiated and approved by the P&C department and ENOC's management. These products and services are then put in place and we evaluate performance, noting any lessons learnt from the implementation of energy-efficient measures across our operations.

In the case of new E&RM procurement, the P&C department shares information related to products and service providers from the market, arranges technical presentations and obtains trial samples for review.

The safety of all products and services must be compliant with the guidelines established by ENOC EHS. Product evaluation and testing is not in the P&C department's remit, but in order to ensure that only the best equipment and services are selected, all products undergo thorough inspection, commissioning and testing carried out by end-user, material-receiving personnel together with EHS. Energy-efficient services maintain the highest standards through training from EHS personnel, work planning, the issuance of relevant permits and so on.

Most recently, we were involved in procuring LED lighting at various ENOC facilities. Based on extensive research, we concluded that the electricity used over the lifetime of a single incandescent bulb costs five to 10 times the original purchase price of the bulb itself. Additionally, LED bulbs last up to 10 times as long as compact fluorescents and far longer than typical incandescent lights. As LEDs do not have a filament, they are not damaged under circumstances when a regular incandescent bulb would be, making them a cost-effective long-term solution that is resilient as regards wear and tear.



**LED bulbs produce only 4% of the heat of incandescent bulbs, reducing the air-conditioning load for our facilities**



**By  
Priyalal Liyanage**

ABOUT  
PRIYALAL  
LIYANAGE



He is the Procurement Controller at ENOC. He holds an MBA and MCIPS in Supply Chain Management. He has over 20 years' procurement experience in onshore and offshore oil & gas projects. His current responsibilities include product, technology and supplier sourcing and the evaluation and development of E&RM projects.



In terms of energy efficiency, LED bulbs produce only 4% of the heat of incandescent bulbs, reducing the air-conditioning load for our facilities. They also use 2 to 17 watts of electricity per unit, making them energy efficient and cost effective. Although LEDs are initially expensive, the cost is recovered over time through these savings.



In this context, we tendered a bid for replacing all lighting units with LED luminaires to a few reputed companies and received many competitive offers. After testing sample units, we made the switch and expect an eight to nine month payback period for this investment.

For another requirement, a new product supplier was introduced to study the plant's efficiency and introduce process-control improvements to save motor electricity loads. The service provider carried out a detailed study and tests. Once we receive the results from the end-user, if it is successful, the P&C department can introduce similar suppliers from the market on similar applications and select technically and commercially competitive systems for other end-user locations.

While the P&C department is involved in securing and implementing all ENOC purchases, we are not involved in evaluating the performance of these measures unless they are directly employed for energy and resource efficiency as a goal. As part of the E&RM technical team, it is our responsibility to evaluate the performance of operationally efficient equipment and services to achieve ENOC's goals for a smooth and streamlined process, with minimal wastage of energy and other resources. ■



# CLIMATE CHANGE

HIS EXCELLENCY  
DR. MATAR AL NEYADI

UNDERSECRETARY OF MINISTRY OF ENERGY,  
UNITED ARAB EMIRATES



A small desert nation with scarce water resources and extensive coastal infrastructure, the UAE is sensitive to the future negative impacts of climate change. The country is dedicating resources to find out with greater precision what a warming world will mean. Concurrently, energy is an important vehicle for economic growth and development and securing affordable and reliable supply is another important factor for the future. Recognising the need to diversify the energy mix, the UAE Government has mandated the use of renewable and nuclear technologies and many important milestones have already been reached in this regard.

Despite this, for the foreseeable future, fossil fuels will continue to dominate the UAE energy mix. They will also continue to be a key pillar of the economy, providing vital revenue via oil and

gas exports. The UAE is coordinating with other Gulf countries, as well as members of the Organization of the Petroleum Exporting Countries (OPEC) and the Arab League, to ensure the interests of oil-producing states are represented as the world seeks to avoid the dangers of changes to the climate. Achieving a sustainable future for the planet is a shared responsibility of all governments and people.

In the 1990s, the UAE was one of the first oil-producing countries to implement a zero-flaring policy at its oil fields, reducing negative environmental impacts and increasing productivity. The country will continue to play a positive role in leading the energy sector towards a more prosperous and cleaner future.

# THIS IS THE UAE'S ROAD TO PARIS

AN ANALYSIS OF THE  
INTERNATIONAL CLIMATE  
CHANGE NEGOTIATIONS

In December this year, the world will meet in Paris to negotiate a new global climate change agreement. This meeting, the 21<sup>st</sup> Conference of the Parties (COP21) to the United Nations Framework Convention on Climate Change (UNFCCC), will be the most important climate-change meeting in over a decade. ➔



MAIN REPORT

By H.E.  
Dr. Thani Al Zeyoudi



In last year's UAE State of Energy Report, I discussed how climate change will affect the UAE – both in terms of direct impacts on our physical surroundings and resources, as well as indirectly, such as by impacting our food security by disrupting agriculture globally. This year, I want to focus on the opportunity we have to shape an effective global response to this challenge.

The ability of the international community to shape a long-lasting and ambitious agreement has been made difficult by two competing dynamics.

The first, is that there can be no long-lasting or affordable development if we lose control of our climate. Climate change presents a risk to the global environment, society and economy. We are at a point now where all countries must join the effort to mitigate their emissions and adapt to climate change.

The second is that, in contrast, many countries fear compromising their development to address a problem to which they may have contributed little. Gulf countries like the UAE face particular challenges. Our emissions account for less than half of one percent of global emissions, but like many countries in the region, fossil fuels are a mainstay of government budgets and revenues.

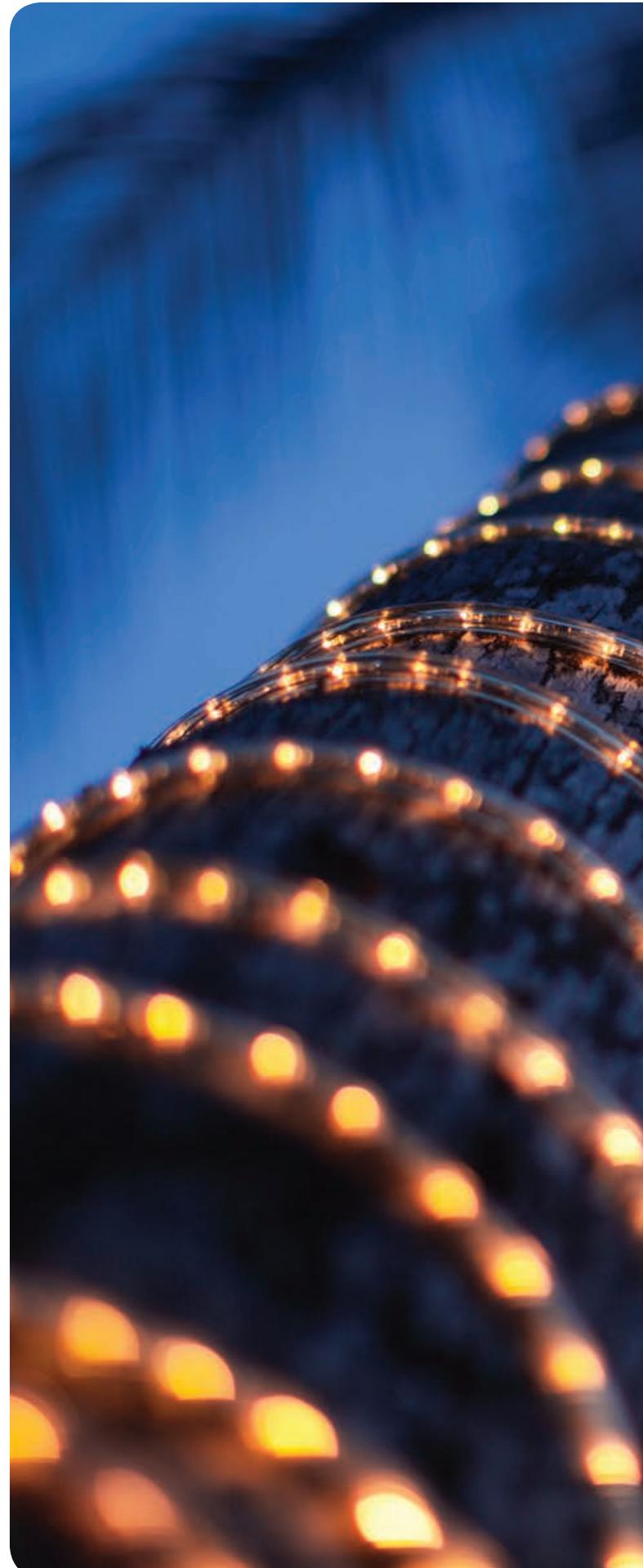
Paradoxically, this is why we are in a position to make a difference and help achieve a meaningful agreement. The UAE experience and perspective can be shared to show that the climate-change challenge is one that is matched with opportunity.

Although oil has been the foundation of our economy, we have always recognised that a comprehensive strategy of diversification is critical for a resilient and sustainable economy. We have diversified through the expansion of our economy into non-hydrocarbon carbon, knowledge-driven industries – from healthcare, to aerospace, to microsystems – and service industries from finance to tourism.

Increasingly, clean-energy technologies are a key part of this diversification. The UAE was the first country in the region to set low-carbon energy targets, where by 2021, 24% of our total energy mix will come from clean-energy sources. These include renewable energy technologies such as wind and solar, and safe, secure nuclear power. Shams One in Abu Dhabi and the ambitious new Mohammed bin Rashid Al Maktoum Solar Park are examples of the world-class investments we are pursuing.

At the same time, we are lowering emissions from fossil fuels in a variety of ways that boost our economy. Most significantly we are finding more efficient ways to use energy. We have adopted efficiency standards for cooling systems and lighting and implemented sustainable buildings standards. Recent lowering of energy subsidies is also intended to encourage more efficient energy use. Our oil industry is already among the most efficient in the world and is developing the region's first commercial-scale carbon-capture project.

As the UAE is now a net importer of natural gas, greater efficiency and use of clean energy leads to major cost savings for the country. And the less oil we use at home, the more is available for export.





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Transforming to a diversified economy requires commitment, patience and support, but it also requires vision and innovation. That is why flagship projects such as Masdar, a world leader in sustainable development, innovation and green technology, and the sustainability focus of Dubai's Expo 2020 plans are so important.

With these actions, the UAE has shown that with the right vision and commitment a country can work within its national circumstances to both limit emissions and enhance its prosperity. The climate agreement needs to support and build upon these kinds of approaches.

One reason that I am optimistic for the coming negotiations is that the international climate regime is becoming more supportive of this vision. We are moving away from the old model of imposing specific emission targets and towards a structure based on nationally determined contributions, which allow countries to work within their own particular circumstances and harness their own strengths.

What is needed now is a framework to build confidence among countries that we are all working together and to provide support and learning that will help all countries do more.

It is this approach and thinking that will guide our engagement in the negotiations ahead of COP21 in Paris. ■

**One reason that I am optimistic for the coming negotiations is that the international climate regime is becoming more supportive of this vision**

**ABOUT  
H.E. DR. THANI  
AL ZEYOUNI**



H.E. is the Permanent Representative of the United Arab Emirates to the International Renewable Energy Agency (IRENA) and the Director of the Directorate of Energy and Climate Change (DECC) within the UAE's Ministry of Foreign Affairs.

# ACCOUNTING FOR UAE'S GHG EMISSIONS

## THE 2014 UAE GREENHOUSE GAS INVENTORY PROCESS AND METHODOLOGY

The Intergovernmental Panel on Climate Change (IPCC) is the organisation under the United Nations (UN), which provides the scientific, technical, and socio-economic information on Climate Change (CC). The first set of guidelines was introduced in 1995, which was revised in 1996. It is called the revised 1996 IPCC Guidelines for National GHG Inventories.

In the year 2006, the IPCC published the 2006 IPCC Guidelines for National GHG Inventories, which provide updated emission factors for certain activities (i.e. how many greenhouse gases are produced by different activities) based on the latest available research.

For Non-Annex 1 parties such as the UAE, the Revised 1996 IPCC Guidelines for National GHG Inventories apply when compiling national GHG Inventories (as opposed to the 2006 update).



**UNITED ARAB EMIRATES  
MINISTRY OF ENERGY**

The resulting emission profile of the country provides GHG emissions divided per sector in terms of Giga grammes (Gg) as well as in tonnes CO<sub>2</sub> equivalent whereby one giga gramme is equal to 1,000 tonnes. There are five key sectors from the IPCC Guidelines that are relevant to activities within the UAE that have anthropogenic emissions. These include the following:

### Energy:

Includes activities such as fuel combustion for electricity, heat and cooling generation, transportation, manufacturing industries and fugitive emissions from coal, oil and gas.

### Industrial Processes, Solvents and Other Products Use (IPPU):

Includes activities such as the production of cement and glass, production of aluminum, and substitutes for ozone-depleting substances such as the use of refrigerants, foam-blown agents and aerosols.

### Agriculture:

Includes emissions from enteric fermentation from livestock or manure management of livestock.

### Land Use Change and Forestry (LUCF):

Includes emission sources and sinks from forests, cropland, grasslands and wetlands.

### Waste:

Includes activities such as solid waste disposal in regards to managed or unmanaged waste-disposal sites, and wastewater with regards to the treatment and discharge of domestic and industrial wastewater.

The Ministry of Energy has mandated Dubai Carbon to carry out a UAE-Wide GHG Inventory for the years 2012 until 2015, to quantify the greenhouse-gas emissions of the country and to create a baseline to benchmark against future best practices and identify opportunities for emission reductions. The GHG Inventory assesses the contribution of each sector of the Emirates including: Abu Dhabi, Ajman, Dubai, Fujairah, Ras Al Khaimah, Sharjah and Umm Al Quwain.

The UAE GHG Inventory is approached in a systematic manner based on the GHG Protocol following planned phases as below:

### Stakeholder communication:

- Out of 500,000+ private, multinational companies in the UAE, the most relevant companies are screened (around 1000+) in target sectors such as large companies, important stakeholders through identifying stakeholder boundaries and required data.
- Further screening is done in accordance with federal and local government entities identifying the major stakeholders (around 300+) in identified sectors and sub-sectors.
- These entities are then contacted and focal points are identified.
- Workshops are held between the project owner, the Ministry of Energy; the project-managing entity, Dubai Carbon; and stakeholders from the aforementioned sectors of the economy. This is done in order to orient stakeholders and receive feedback from previous cycles.
- This phase has been carried out over three months annually, from April until June, simultaneously with data gathering and evaluation, and progress is regularly communicated to the Ministry of Energy by Dubai Carbon.

### Data gathering and evaluation:

- Sector and entity-specific data questionnaires are developed based on requirements as per IPCC guidelines and methodologies. These data requests are sent with appropriate guidelines.
- Received data provides an overview of existing initiatives.
- Evaluation is done to assess data gaps and uncertainties.
- This phase is being carried out over four months, running from April until July.

### GHG Calculation:

- One part of the team performs the calculation, based on the Revised 1996 IPCC Guidelines for National GHG Inventories and divided into the five sectors.
- Activity data received from the major stakeholders and relevant emission factors are used with specific calculation tools to report emissions from different sectors.
- Parameters and assumptions are based on credible resources and core industrial understanding.
- Results are analysed to identify largest contributors according to sector and Emirate. Emissions per sector, per entity, per type of gas, fuel, and activity are identified and calculated.
- This phase starts as soon as a viable amount of data is collected, approximately May, and is projected to end in September.

### Quality Assurance:

- Another part of the team that was not involved in the calculation performs quality assurance through cross checking calculations with corresponding IPCC methodologies, and double checking parameters and assumptions with current available information.
- Quality assurance is also carried out in later phases of the project.
- The various tools used to ensure high-quality management and verification are direct technical assistance, inventory management plans, desk reviews to identify areas for improvement in quantifying and reporting emissions, on-site reviews to physically check on issues, and verification to enhance the credibility of reported data.
- This phase is carried out throughout the length of the project cycle, from April till December.

### Benchmarking:

- Benchmarking is carried out at regular intervals on each entity's data to cross-check against the previous year's data.
- This ensures data consistency and provides a basis for understanding trends due to internal operational changes. It also helps in determining whether all requirements have been adequately reported and provides an external perspective by providing feedback to participants.
- This phase is started as soon as data is received in May and lasts until the end of the GHG calculation phase in September. This is also regularly communicated to the Ministry of Energy by Dubai carbon.

### Reporting and Feedback:

- Once the data gathering, evaluation and calculation is completed, a comprehensive report is prepared to capture the data gathered, sectoral analysis and national trends.
- This phase lasts three months, from October until December, and gathers regular feedback from the project owner. It is submitted to the Ministry by Dubai Carbon at the end of the project cycle.
- This in turn becomes a tool for policy and decision-making and can be communicated to the international community.

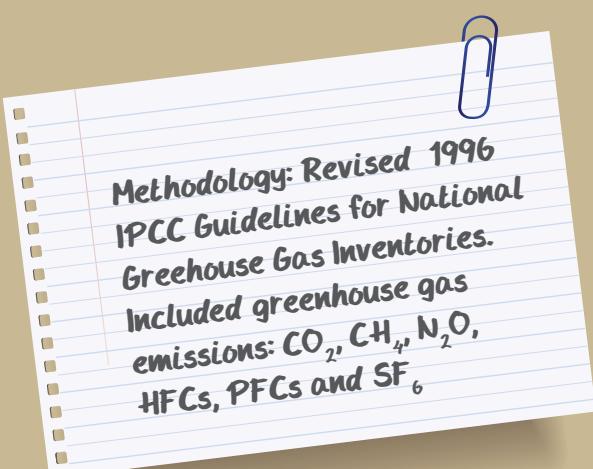


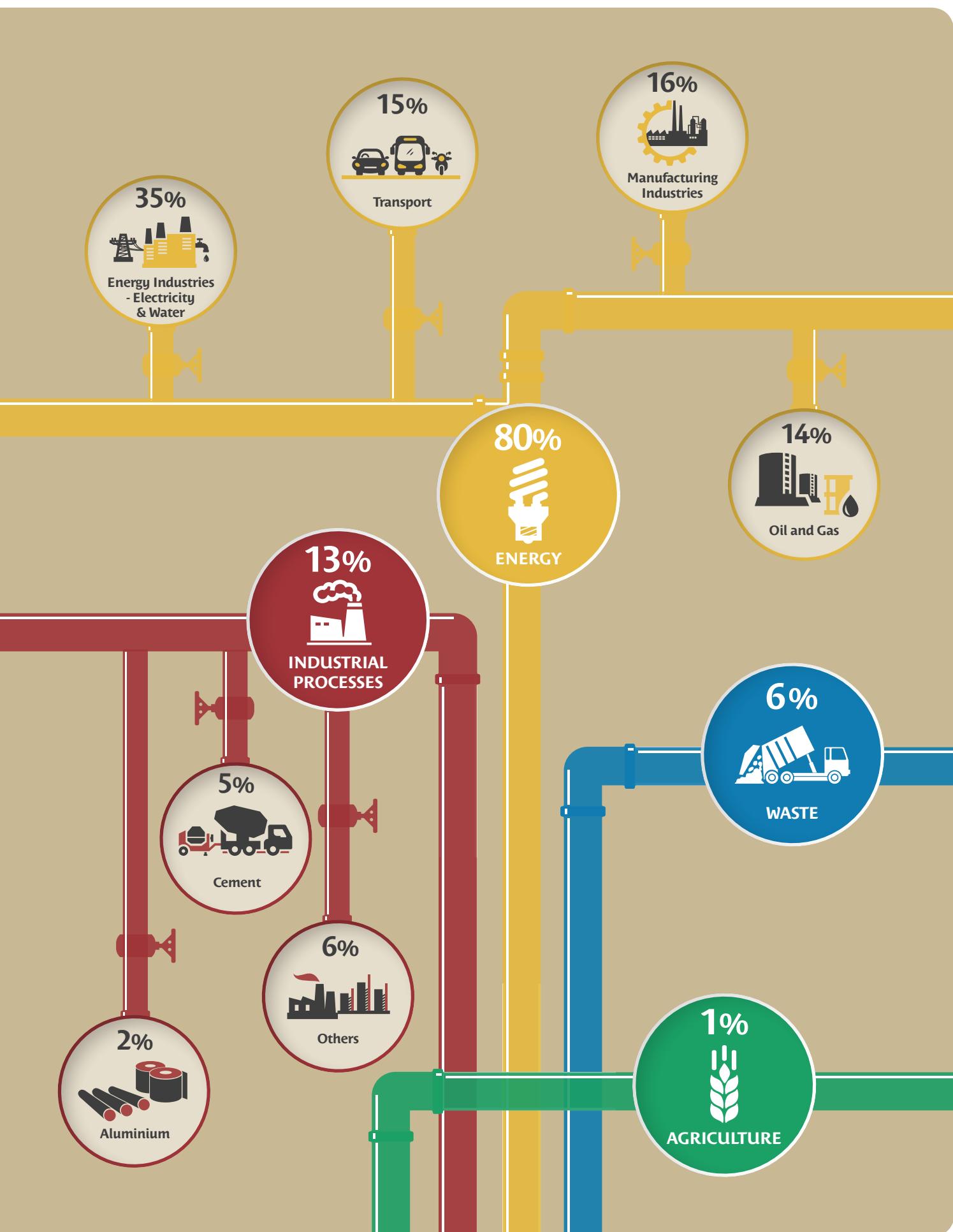
For Non-Annex 1 parties such as the UAE, the Revised 1996 IPCC Guidelines for National GHG Inventories apply when compiling national GHG Inventories

# UAE GREENHOUSE GAS INVENTORY

## 2014

As part of its ongoing effort to compile and manage greenhouse gas emission data in the UAE and the transparent approach of sharing this information with the public, the UAE Ministry of Energy has prepared a preliminary greenhouse gas inventory for 2014. The process has been managed in cooperation with Dubai Carbon and the support of our valuable stakeholders. The following information is subject to ongoing quality control and data verification and provides a preliminary snapshot for the status in October 2015 only. The fully verified greenhouse gas inventory is expected to be published in quarter one 2016. ■





# CLEAN DEVELOPMENT MECHANISM AND THE UAE DESIGNATED NATIONAL AUTHORITY: AN INTRODUCTION



ARTICLE

By Eng. Meshayel Omran  
Lehssoni & Eng. Reshma Francy



UNITED ARAB EMIRATES  
MINISTRY OF ENERGY

Global leaders are currently discussing the need for serious action against climate change. The 21<sup>st</sup> Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) to be held in Paris at the end of this year is one of the last opportunities for humanity to implement meaningful action to solve the problem. The future of generations to come depends on the actions of humanity at present.

The link between greenhouse gases and their impact on the temperature of the Earth was first mentioned as far back as 1824. In the last century, the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) formed the Intergovernmental Panel on Climate Change (IPCC), a scientific body to investigate the issue. The first assessment report of the IPCC was released in 1990. Since then scientific knowledge has evolved to a point that few dispute that the large amounts of greenhouse gases in the atmosphere are having a profound impact on climate.

Currently, the only agreement on actions to be taken to reduce emissions is the Kyoto Protocol. It distinguishes the roles of the developed and developing countries. The UAE is not an Annex I country based on the national circumstances, which means it is not required to take legally-binding measures to limit its emissions. At the same time, the country is eligible to participate in the Clean Development Mechanism (CDM), a programme under the Kyoto Protocol which allows for developed countries to offset some of their emissions through supporting projects in developing countries.

CDM provides a funding framework for developing countries that implement projects with emission-reduction benefits. Such projects are screened and those that fit the relevant criteria can apply for certified emission reductions (CERs)<sup>1</sup> based on the amount of greenhouse gases reduced. The CERs are purchased by the Annex I parties to meet their emission-reduction targets.

The UNFCCC has defined a project cycle and set of methodologies which can be used to establish emission-reduction benefits. Project owners who wish to register under CDM are required to follow the appropriate methodology and explain their project through a Project Design Document (PDD).

The UAE is one of the leaders in the region in terms of the number of CDM projects implemented.

## The Designated National Authority and the CDM Process

CDM requires the creation of a designated national authority (DNA) in each country. The DNA functions as a focal point for the UNFCCC CDM Executive Board. The DNA provides the host country's letter of approval on a national level and facilitates participation in the mechanism. The letter of approval confirms the following:

- 1 A project is in alignment with the sustainable development of the country
- 2 The country has ratified the Kyoto Protocol
- 3 The participation in the CDM is voluntary

In the UAE, the designated national authority is the Ministry of Energy. The focal point for the UNFCCC is H.E. Eng. Fatima Al Foora Al Shamsi, Assistant Undersecretary of Electricity, Clean Energy and Desalinated Water Affairs. The update on the DNA focal point is now available on the UNFCCC website:  
<https://cdm.unfccc.int/DNA/bak/index.html>

The CDM Executive Committee is responsible for issuing the letter of approval for each project in the UAE. The Ministry of Energy hosts the CDM Executive Committee meetings and manages the CDM Executive Committee Secretariat.



**The UAE is one of the leaders in the region, in terms of the number of CDM projects it has implemented**

## ABOUT ENG. MESHAYEL OMRAN LEHSSONI



She is the Acting Director for Clean Energy and Climate Change department, Ministry of Energy, UAE. She joined the Ministry of Energy in 2013. She is responsible for the department of Clean Energy and Climate Change activates, including the preparation of the fourth national communication report for the UAE to be submitted to the United Nations Framework Convention on Climate Change and the Greenhouse Gas Inventory of the United Arab Emirates.

## ABOUT ENG. RESHMA FRANCY



She is a Senior Climate Change Engineer, Ministry of Energy. She holds a Master of Science in Engineering Systems and Management from the Masdar Institute and has worked in the field of climate change since her graduation. Her experience includes the IPCC GHG inventory methodologies, policy and strategy development and clean development mechanisms.

The following steps lead to obtaining a letter of approval within the UAE:

- 1 Receiving the endorsement pack from the project activity applicant. The endorsement pack provides the PDD as well as the project concept note in Arabic for review by the CDM Executive Committee members
- 2 Review of the CDM endorsement pack by the CDM Executive Committee members
- 3 Presentation of the project and exchange of feedback between the CDM chair and the secretariat
- 4 The letter of approval is issued once all the members have expressed their lack of objection

## The CDM Executive Committee

In February 2015, the CDM Executive Committee was restructured in accordance with Ministerial Decree No. 26/2015. The committee is chaired by H.E. Undersecretary of the Ministry of Energy Dr. Mattar Al Neyadi. ■

### The CDM Executive Committee Chart:

CDM EC Chairperson – H.E. Dr. Mattar Al Neyadi

CDM EC Secretariat – Clean Energy and Climate Change Department MOENR



- 1| Certified Emission Reduction (CERs) are the tradeable units of the CDM. CERs are defined in 3/CMP.1, Annex, paragraph 1(b) as follows: A “certified emission reduction” or “CER” is a unit representing one tonne of carbon dioxide-equivalent ( $\text{CO}_2\text{-e}$ ) sequestered or abated, using global warming potentials defined by 2/CP.3. CERs are issued to project participants in CDM projects pursuant to Article 12 of the Kyoto Protocol and the CDM modalities and procedures (3/CMP.1, Annex, paragraph 1(b)).

Source: <http://www.cdmrulebook.org/304.html>

# CDM PROJECTS GENERATING CARBON CREDITS

**The Clean Development Mechanism (CDM) is a United Nations programme that encourages the implementation of climate-friendly technologies in developing countries. Within the region, the UAE has established itself as a leader in developing projects aided by the scheme.**

Currently, there are 14 projects registered in the programme in the UAE and several more in the pipeline, with the first UAE projects registered in 2009. So far, certified emission reductions (CERs) equaling 617,974 tCO<sub>2</sub> have been issued to the registered projects from the UAE.

In terms of issued credits to date, the country's biggest project was implemented by the Emirates CMS Power Company in Abu Dhabi. It involved the installation of heat reclaimers to recover waste heat and generate low-pressure steam at the facility. The project is long running and successful in operational implementation with a total of 476,446 tCO<sub>2</sub> of CERs issued so far.

Of all the UAE projects registered in CDM to date, most have been implemented within the energy industry. Among them are renewable energy plants in Abu Dhabi and Dubai. The Capital's foray into renewable energy started with a photovoltaic plant with a capacity of 10 megawatts (MW) initiated

by clean-energy company Masdar and built on the premises of Masdar City. The plant has been issued CERs of 11,786 tCO<sub>2</sub> for the operation from its start until June 2010. Also in the Capital, the Shams One concentrated solar plant became the first facility of its kind worldwide to be registered under CDM. The plant is generating reductions equal to an estimated 174,800 tCO<sub>2</sub> per year. In Dubai, the 13MW photovoltaic plant commissioned by the Dubai Electricity and Water Authority (DEWA) has been in operation since the end of September 2013. The project has generated CERs equal to 10,635 tCO<sub>2</sub> from the start of its production until July 2014.

Another energy project initiated by DEWA has sought to improve the efficiency of the three gas turbines at a power plant in Dubai. The installation of an inlet air chilling system increased the average efficiency of the plant's gas turbines by 2%.



ARTICLE

By Fazil Abdul Rahiman  
and Suraiya Tasnim



In the industrial sector, cement companies have realised the opportunities presented by CDM. The industry is energy-intensive and globally, cement companies have enjoyed large opportunities for savings through implementing efficiency projects. In the Emirate of Ras Al Khaimah, the Union Cement Company installed a waste-heat recovery system at one of its operation lines. The system is comprised of two preheater boilers and one air-quenching cooler boiler producing steam, which is in turn used to generate electricity. Per year, the system produces some 82,086MWh of electricity.

CDM has also funded a project in Abu Dhabi to reduce fugitive emissions from the oil-production sector, as well as the capturing of methane emissions from landfills in Ras Al Khaimah and Dubai.

Currently, three more projects – in Sharjah, Ras Al Khaimah and Dubai – are under validation. The biggest among them is a new solar photovoltaic plant in Dubai, which will have a capacity of 200MW (maximum power output) and is scheduled for completion in 2017.

Moving forward, the UAE is keen to pursue a programme of activities (PoA) approach, registering the coordinated implementation of various emission-reduction policies. Such an approach has a number of benefits. For example, once a PoA is registered, an unlimited number of component project activities can be added without undergoing the complete CDM project cycle. This means a faster approval process and reduced transaction costs and investment risks. Most importantly, it enables smaller projects, which would otherwise not be viable, to access CDM funding.

This format also allows for emission-reduction measures to be scaled up faster, as unlimited component project activities can be added once a PoA is registered.

**Currently, three more projects – in Sharjah, Ras Al Khaimah and Dubai are under validation**



## ABOUT SURAIYA TASNIM



She is a Project Officer at the Dubai Carbon Centre of Excellence. She has a strong background in environmental sciences, economics, renewable energy and climate change. She has over three years' experience in implementing projects and capacity building in the fields of energy, sustainability, carbon finance and climate change mitigation within government, private and multinational funding agencies. Her primary focus is Clean Development Mechanism (CDM), Nationally Appropriate Mitigating Actions (NAMA), carbon footprinting, energy efficiency and renewable energies.

## ABOUT FAZIL ABDUL RAHIMAN



He is the Assistant Technical Manager at the Dubai Carbon Centre of Excellence. He is an energy and sustainability consultant with over 6 years of experience comprising the areas of project management, consulting, R&D and engineering. Currently in his role as Assistant Technical Manager at Dubai Carbon Centre of Excellence (DCCE), he manages projects dealing with emission reduction strategy and policy, energy efficiency, renewable energy and climate change mitigation.

A number of government initiatives that are already taking place can benefit from pursuing the PoA approach. This is the case with efforts underway in Dubai to implement energy performance contracting and create a viable ESCO industry. There are already a number of small-scale similar projects in the country, which are individually not applicable for CDM registration, but could be grouped together under one umbrella and use a unified monitoring methodology. District cooling and lighting efficiency projects can also potentially qualify for support.

# ABU DHABI'S QUANTIFYING GREENHOUSE GAS EMISSIONS AND THE EMISSIONS ROADMAP



ARTICLE

By Sheikha Al Hosani,  
Ruqaya Mohamed, Hussein  
Hamed & Mouza Al Zaabi

## ABU DHABI'S DRIVE TO BUILD A COMPREHENSIVE AND ROBUST INVENTORY

In 2013, the Environment Agency Abu Dhabi (EAD) launched the first greenhouse gas (GHG) inventory for the Emirate of Abu Dhabi. This was an initiative where the key objective was to support the UAE Government in fulfilling its commitment to the United Nations Framework Convention on Climate Change (UNFCCC), as well as to provide robust baseline data to support strategic air-quality objectives in the Emirate.

After a period of two years of close collaboration with 16 local and federal government stakeholders, the initiative identified and quantified GHG emissions and removals, from their sources and sinks respectively<sup>1</sup>, in accordance with the Intergovernmental Panel on Climate Change's (IPCC) procedures and guidelines.

A comprehensive inventory of carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), sulphur hexafluoride (SF<sub>6</sub>), perfluorocarbons (PFCs) and hydrofluorocarbons (HFCs) was compiled for the energy, industrial processes, agriculture, land-use change and forestry and waste activity sectors. The inventory tracked GHG sources and sinks for the year 2010, the most recent year that had the most accessible data, as well as being representative of a period of high economic development.

The detailed and up-to-date listing of GHG emissions and removals in Abu Dhabi contributes to the UAE's national GHG inventory, as well as allowing researchers and policy-makers to set effective GHG mitigation policies for the Emirate.

The project not only established the baseline for the GHG data necessary for assessing future environmental improvement measures, but also contributed to capacity-strengthening of local entities in terms of competence-building and knowledge-transfer for estimation and reporting of emissions.

The UAE is the first country in the region to conduct this initiative with such attention to the geographical and sub categorical level of detail. Such efforts will facilitate the development of an Emirate-wide estimate, focused analysis and assessment of sources and emissions across finer geographic zones, which will lead to reliable local and regional climate change projections or modelling in the Middle East.

The project would not have been possible without the stakeholders' unwavering commitment to the agreed framework, which was demonstrated by regular engagement to share ideas, knowledge, skills, challenges and success stories.

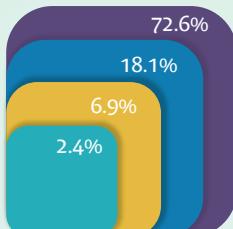
Much effort went into compiling the activity data, with the various stakeholders contributing data collected from primary data sources through sectorial questionnaires, as well as from secondary published studies and annual reports. This process was greatly enhanced by the effective capacity-building workshops that were held as part of the stakeholder engagement process.





The total GHG emissions for Abu Dhabi Emirate were 99,101 Gg CO<sub>2</sub>e eq. in 2010, with the dominant source of the emissions being the energy sector with a contribution of 72.6% of total emissions. The energy industries' activities, comprising electricity production combined with water desalination, oil and gas extraction and oil refining, were the main sources of those emissions. Approximately 4.7% of total emissions were sequestered by the extensive system of hardwood tree plantations throughout the Emirate.

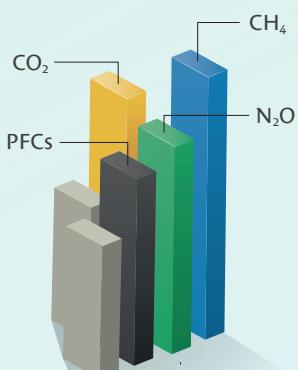
## Subsectoral Share of GHG Emissions



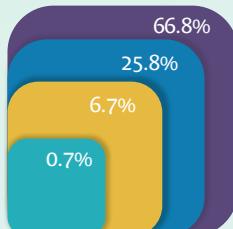
- Agriculture
- Waste
- Industrial Processes
- Energy

The main GHG emission was CO<sub>2</sub>, constituting about 78.6% of total GHG emissions. Emissions of HFCs and SF6 were negligible as the products containing these gases are not produced in the Emirate.

## Breakdown Of Direct GHG Emissions By Gas



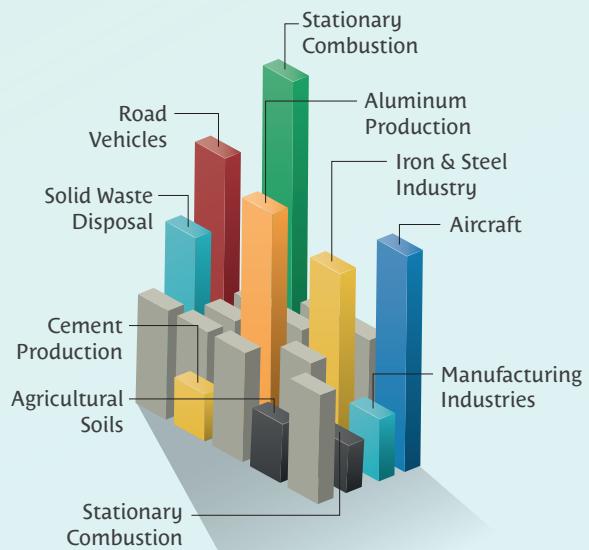
## Subsectoral Energy GHG Emissions



- Others (Red, Com, Agr)
- Manufacturing Industries & Construction
- Transport
- Energy Industries

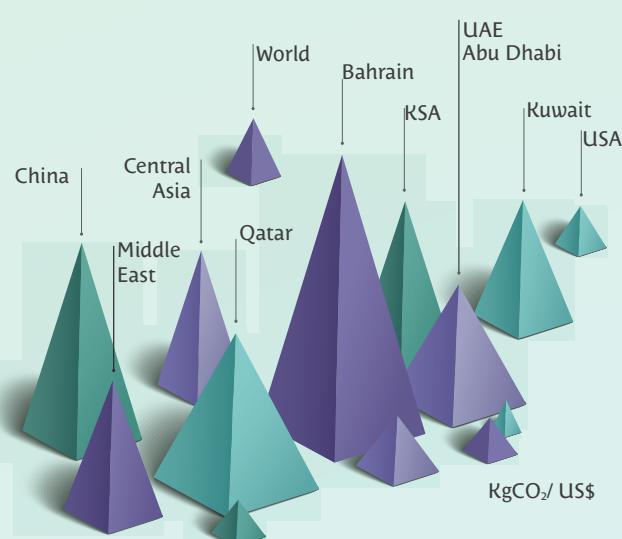
A key category analysis was performed for the GHG emissions, which entailed identification of the key sources responsible for 95% of the total emissions. This allows identification of those emission categories that require particular attention.

## Key Sources and GHG Emissions in Abu Dhabi Emirate

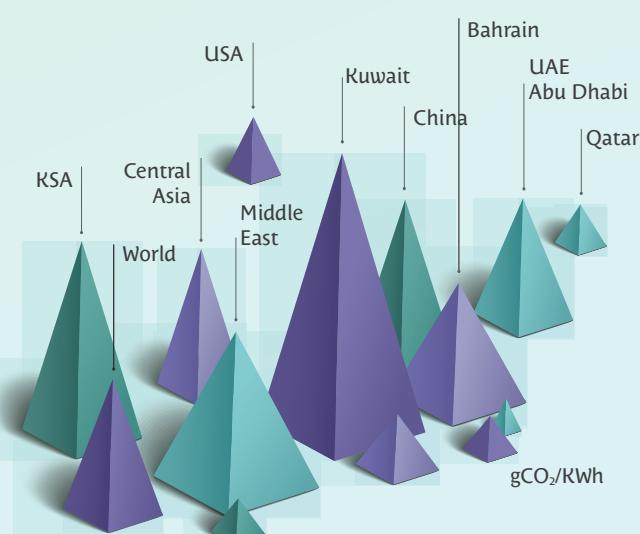


Three emission indicators were developed for Abu Dhabi Emirate using the criteria of the International Energy Agency (IEA): the per capita emissions and per GDP and per kWh electricity produced. Analysis showed that the emission indicators linked to the economy or electricity production are lower than those of many of the neighbouring countries and the world average.

### Per GDP CO<sub>2</sub> Emissions From Fuel Combustion in 2010



### Per KWH CO<sub>2</sub> Emissions from Electricity Generation in 2010



1] A carbon sink is anything that absorbs more carbon than it releases, whilst a carbon source is anything that releases more carbon than is absorbed.  
<http://www.fern.org/campaign/carbon-trading/what-are-carbon-sinks>

The Abu Dhabi GHG inventory provided a set of high-level policy recommendations to be considered for future updates. These recommendations are organised in terms of methodology needs, organisational needs, partnerships, competence-building and research activities.

The GHG emission inventory compilation initiated during this project constitutes a valuable basis for further work. It is strongly recommended to build on this initial successful inventory compilation process and establish a mature, iterative process to improve and compile GHG emissions, following two-year cycles. Accordingly, EAD has set a plan for bi-annual GHG inventories that would enable understanding of the emissions trend along with economic development and the various mitigation efforts in the Emirate, and also support national communication to the UNFCCC. The second cycle of the GHG inventory, started at the end of 2014, is still ongoing. It involves updating the GHG inventory with data from the year 2012, as well as an assessment of future GHG emissions for the year 2030, based on approved plans and the intentions of policies for emission reductions. Projection of emissions will inform policy-makers about the efficiency of emission-reduction measures and legislation and thus form a basis for future work on the development and assessment of different emission scenarios.

The importance of a robust GHG inventory cannot be emphasised enough. It is a critical component of current and future modelling work, be it for climate-change scenario building; emission-reduction assessments and co-benefit assessments; emissions projections or economic-development activity planning.

Models are an indispensable tool in the efforts to predict the potential impact of various human activities on the climate as well as on air quality. A fundamental fact in modelling exercises is that models are only as good as the data and data sources used to drive them. This fact makes the compilation of proper, comprehensive inventories imperative and it is one more factor in ensuring that policy-makers and decision-makers have the necessary information for formulating effective mitigation and prevention measures. ■

#### ABOUT SHEIKHA AL HOSANI



She is the Deputy Executive Director of the Environment Quality Sector at the Environment Agency – Abu Dhabi.

#### ABOUT RUQAYA MOHAMED



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#### ABOUT HUSSEIN HAMED



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She is an Assistant Scientist in the Air Quality in the Noise and Climate Change Section at the Environment Agency – Abu Dhabi.

# CARBON ABATEMENT STRATEGY 2021:

## LOCAL ACTION, GLOBAL CHANGE



ARTICLE

By Taher Diab  
& Ilham Talab



Dubai has taken progressive strides in addressing the global issue of climate change through demonstrated initiatives in energy security, renewables and energy efficiency. Championed by the vision of His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, to pursue a green economy for sustainable development, the Emirate has created a platform to drive specific programme and projects, where opportunities and innovation can address energy challenges.

The Dubai Supreme Council of Energy (DSCE) recognises the significance of integrating a carbon abatement strategy as an essential element in the quest for sustainability. This means positioning the issue of a low-carbon economy in the planning and execution of the Dubai Integrated Energy Strategy – 2030.

A first in the region, the Dubai Carbon Abatement Strategy 2021 details programmes that integrate alternative and renewable energy to diversify Dubai's generation mix, manage the demand to increase efficiency and develop sector-based reduction targets for greenhouse gases (GHG).

The United Nation's Framework Convention on Climate Change (UNFCCC) has set a goal of restricting the rise in temperature this century to 2°C, to limit human impact on the climate system. Global action is vital and starts locally. As more than half the global population lives in cities where the majority of carbon emissions are associated with energy consumption, the involvement of cities is critical. Therefore, the significance of building a low-carbon economy transcends beyond the vision of Dubai, contributing to a concerted global effort to meet this limit. The Emirate of Dubai, the fifth-fastest growing city in the world with respect to 300 of the largest metropolitan economies, had an annual growth rate in Gross Domestic Product (GDP) per capita of 4.5% from 2013-14<sup>1</sup>. Consequently, Dubai has implemented progressive actions to curb its carbon emissions while sustaining economic growth. In integrating smart technologies and conducive regulatory frameworks, these programmes include green building regulations, solar energy, waste minimisation, the green mobility initiative and an increased share of public transportation. With this, the Emirate joins an elite group of cities that are actively managing their carbon emissions.

## CLIMATE CHANGE



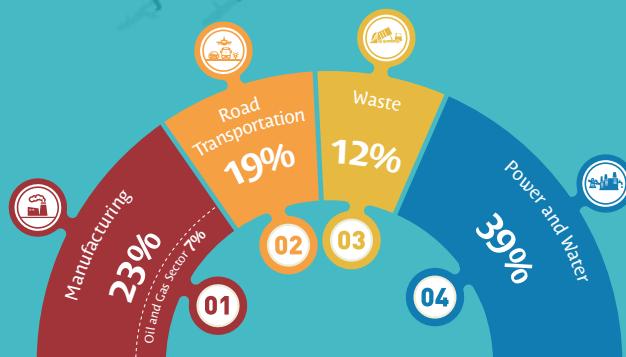
Dubai CAS 2021 is aligned with UAE National Vision 2021: Achieve 24% share of renewable energy, 90% Air Quality Index and 75% of waste to be treated

### The Dubai Carbon Abatement Strategy 2021

To design a targeted programme for carbon abatement, the strategy defined major sectors contributing to carbon emissions, referred to as "high impact sectors". Based on the carbon emissions profile for 2011, these sectors are: power and water, manufacturing, road transportation and waste, as illustrated in Figure 1.

A technical evaluation of the emission-reduction potential for these high-impact sectors was carried out with the support of the Dubai Carbon Centre of Excellence, resulting in a target of a 16% reduction of greenhouse-gas emissions (GHG) by 2021, in comparison with business-as-usual estimations for the same year.

Figure 1: Dubai's GHG emissions baseline (2011) across four main sectors.



### ABOUT TAHER DIAB



He is the Senior Director – Strategy & Planning at the Dubai Supreme Council of Energy and the Secretary General – Emirates Energy Award. His career includes over 26 years of diversified experience in business planning, strategy development, corporate governance, sustainability and HSE and quality-management systems. He is actively involved in the strategic development of diversified energy sources, demand and supply management in Dubai and devising work plans for achieving Dubai's Integrated Energy Strategy 2030.

### ABOUT ILHAM TALAB



She is a Business Analyst – Strategy & Planning at the Dubai Supreme Council of Energy. She currently supports strategic decision making for the Dubai energy sector through the development of the Integrated Energy Strategy 2030. Previously, She worked at the International Renewable Energy Agency (IRENA), designing and implementing capacity-building programmes to assist developing countries in the transition to sustainable-energy futures.

## Capturing Potential through Concerted and Streamlined Efforts

To achieve the objectives of the Dubai Carbon Abatement Strategy 2021, engagement of stakeholders was paramount to complete the development of carbon-reduction targets and reach the execution phase in 2015. The process commenced in 2011, when the DSCE, along with Dubai Carbon, developed the first inventory of carbon emissions for Dubai's major sectors and set it as a baseline. To realise Dubai's regional and global position, a benchmark was completed for various sectors to guide the level of ambition and learn from best practices. Since then, DSCE and its entities have continued to improve data-gathering methods and quality. With four years of data to date, Dubai's emission profile has been enhanced to accurately reflect the local environment and major sources of emissions. In 2015, these collaborative efforts delivered a detailed work plan with sector-based targets that is being implemented by DSCE entities. A technical committee shall review progress and track performance on a regular basis.

Progress is already being made, demonstrated by reported savings in the comprehensive Demand Side Management (DSM) strategy of Dubai. Between 2011-2014, electricity consumption savings exceeded the target and reached 1.9 TWh<sup>2</sup>. Similarly, water consumption savings exceeded the target and reached 3.5 BIG<sup>3</sup> from 2011-2014.

Major entities, such as Dubai Electricity and Water Authority (DEWA), are embarking on various measures to continue their emission-reduction trajectory, including supply-side energy efficiency (investment in efficient technology, reduction of system losses in transmission and distribution networks, among others), diversifying the energy mix using renewable sources (15% of installed capacity to be based on solar energy by 2030. Currently, a 13MW solar PV plant is operational and an additional 200MW is under construction). Consumer behaviour is also an essential component of Dubai's Carbon Abatement Strategy 2021. DEWA is disseminating targeted educational campaigns to redirect behavioural inertia towards more savings in electricity and water.



### Dubai CAS 2021 contributes to Dubai EXPO 2021: To be a carbon neutral mega-event with sustainability as one of the main themes.



### Dubai CAS 2021 contributes significantly to Dubai Plan 2021: For a clean, healthy and sustainable city

Dubai Aluminium (DUBAL), now part of Emirates Global Aluminium (EGA), has also achieved major milestones in its carbon-management strategy. A reduction of 5.2% of CO<sub>2</sub>e/tonne aluminium was achieved in 2014 compared to 2011<sup>4</sup>. The Road and Transportation Authority (RTA) has also demonstrated significant expansion of its sustainable and alternative transportation plans. The 75-kilometre Dubai Metro and its expansion, in addition to the introduction of hybrid vehicles as part of RTA taxi fleet, are major initiatives designed to lower fuel consumption and increase system efficiency in the transportation sector. In addition, Dubai Municipality is implementing measures and programmes to increase the rate of recycling and decrease the volume of landfill waste.

## Leading by Example

The Dubai Carbon Abatement Strategy 2021 highlights the importance of securing a sustainable future while maintaining strong economic growth. By pioneering one of the first comprehensive carbon-abatement strategies in the region, Dubai is placing itself at the forefront of the sustainability journey. The detailed work plan of the Dubai Carbon Abatement Strategy 2021 and its key performance indicators aim to decrease GHG emissions by 16%, compared to BAU in 2021 from government entities and industries. Therefore, Dubai is leading by example, with local steps that will contribute to global change. As the DSCE and its entities embark on implementing emission-reduction programmes, Dubai will enjoy increased resource efficiency across all sectors. In addition, the Emirate is witnessing increased investment in innovative technologies and stimulation of the private sector to contribute to this low-carbon development agenda. The outcome of the Dubai Carbon Abatement Strategy 2021 will no doubt be the result of concerted efforts and high-level commitment from all relevant stakeholders, with continuous monitoring to track progress towards Dubai's vision to become the capital of the world's green economy.



<sup>1</sup>| Brookings Global MetroMonitor 2015  
<http://goo.gl/xgSzWN>

<sup>2</sup>| TWh: Terawatt-hours

<sup>3</sup>| BIG: Billion imperial gallons

<sup>4</sup>| UAE State of Energy Report 2015



# NOT WASTING HEAT

**WASTE HEAT RECOVERY  
TECHNOLOGIES WITHIN  
THE CEMENT INDUSTRY**

**STAR Cement Co L.L.C** is part of a USD 40 billion corporation in the league of Fortune 500 companies. The corporation is one of the leading cement producers globally and India's largest producer of grey cement, white cement and ready-mix concrete. Operations span India, the UAE, Bahrain, Bangladesh and Sri Lanka. Star Cement is an ISO 9001 and 14001 certified company and is the foremost cement manufacturer in the Middle East and Asia, with a total installed capacity of 3.1 million metric tonnes per annum cement (MTPA). It has state-of-the-art clinker and cement-grinding facilities at Ajman and Abu Dhabi in the UAE, Bahrain, Bangladesh and a clinkerisation plant at Ras Al Khaimah in the UAE.

The main objective of the project is to utilise waste heat from the clinker production line, which is currently being released into the atmosphere, for generating electric power that will be utilised on site. The power produced by this project will displace power that is currently being produced by the fuel oil-based captive power plant. The project will contribute to the more efficient use of energy at the clinkerisation plant, reduce reliance on fossil fuel and reduce the cost of production.



ARTICLE

By  
**TVS Chidambaram**



The project consists of the installation of a heat-recovery system on the clinker cooler in phase I and the heat recovered will be converted to power, which will be supplied to the internal plant grid. The following three technologies are typically used in cement plants for power generation from waste-heat sources.

Rankine cycle is a thermodynamic cycle, which converts heat into work (power in this case). The heat is supplied externally to vaporise the working fluid (water) in the boiler into high-pressure steam which expands in the turbine to produce power through rotation. The expanded vapour is condensed to low-pressure liquid in the condenser and is recycled back to the boiler for continuing the cycle. The waste heat recovery (WHR) system, effectively utilises the available waste heat from the exit gases of pre-heater and clinker cooler. The WHR system consists of a suspension pre-heater (SP) boiler, an air quenching chamber (AQC) boiler, a steam turbine generator, a distributed control system (DCS), a water-circulation system, a dust-removal system and so on.

The Organic Rankine Cycle (ORC) uses a high molecular mass organic fluid. It recovers heat from even low temperature sources. Due to this, it finds its applications in cement industries, geothermal, solar ponds, and similar. Heat available in the low-temperature gas of the clinker cooler exhaust can be recovered effectively by installing a waste-heat power plant based on ORC. This cycle is environmentally affable and is well-suited to work with lower temperatures to generate electricity on a continuous basis without interfering with the clinker production process. The low-temperature heat is converted into useful work, which is in turn converted into electricity.

The Kalina cycle was developed by Dr. Alex Kalina as a means of improving the overall efficiency of combined cycle plants. The main benefit of the Kalina cycle is that the heat addition to the process happens at variable and very low temperatures. The temperature range required for the boiling of the ammonia-water mixture in the Kalina process is 95°C - 500°C minimum. The main components of the Kalina cycle include a vapour turbine-generator, evaporator, separator, condenser, recuperator exchangers and feed pump. The working fluid is an ammonia-water mixture. The conspicuous efficiency advantage characteristic of the Kalina cycle is realised from the heat-exchange processes of the heat acquisition in the evaporator and the heat rejection in the condenser. Additional efficiency is achieved by the recuperator exchangers. These gains are made possible by the variable boiling and condensing characteristics of the ammonia-water mixture working fluid as it varies in concentration at different points in the cycle. Typically Kalina based systems can have 5 to 25% more power generation compared to other two cycles with a very low requirement of water.

The generated power utilises waste heat and will therefore not produce any additional greenhouse-gas (GHG) emissions and will contribute to the sustainability of the cement sector specifically through the following.

Improving energy efficiency through demonstrating efficient technology, as well as lowering the cost of production at Star Cement Ras Al Khaimah plant

Reducing reliance on fossil-fuel based power sources

Reducing local air pollution and the associated adverse health impacts

Reducing global emissions of greenhouse gases to combat global climate change ↗



**The temperature range required for the boiling of the ammonia water mixture in the Kalina process is 95C - 500C minimum**

This waste-heat recovery within the cement plant is a cost-effective way of reducing CO<sub>2</sub> emissions. This is a prime technology candidate for carbon emission reduction projects. The technology has the dual benefits of lowering fuel costs and reducing emissions. The project is designed to give a reliable operation predictable savings, preventing global warming and reducing emissions of CO<sub>2</sub> gases.

The production of clinker consumes substantial amounts of energy, of which part is lost into the atmosphere in the form of waste heat. At Star Cement Ras Al Khaimah, a significant amount of heat is vented, primarily in two locations:

- The preheater stage, where the exhaust from the top cyclones are vented for further application like raw-material drying as well as coal-mill drying, where partial amount of hot gases are utilised. The remaining hot gases as well as the used hot gases are dedusted and sent into the atmosphere.
- The second location is at the clinker cooler. Here, after quenching the hot clinker by the atmospheric air, part of the hot air is utilised for the combustion process inside the kiln and the remaining excess hot gas is vented into the atmosphere after dedusting.

Hence, the waste heat from the preheater exhaust as well as cooler exhaust is available for recovery without affecting the cement manufacturing process.

Star Cement has opted for the new Kalina technology for power generation from the waste heat of the cooler exhaust to produce 4.75MW of gross power due to higher power-generation capabilities compared to other systems, with a minimal requirement of water. The complete project is being done on an EPC basis by FL Smidth Denmark / India and the plant is under the commissioning stage. ■

### ABOUT TVS CHIDAMBARAM



He is the Chief Operating Officer of Star Cement. He is a chemical engineering graduate with over 31 years of experience in cement manufacturing in countries such as India, the UAE, Saudi Arabia, Bahrain, Oman, Sudan, Yemen and Bangladesh. He has experience in projects, O&M, optimisation, energy efficiency and waste-heat power generation.

# MAPPING CLIMATE CHANGE IMPACTS ON PUBLIC HEALTH



ARTICLE

By Ahmed Baharoon  
& Jane Glavan

THE DEVELOPMENT OF A MODEL THAT HELPS US UNDERSTAND HOW CLIMATE CHANGE MITIGATION CAN ENHANCE PUBLIC HEALTH



Climate change, a serious environmental challenge driven by greenhouse gases (GHG) emitted as a result of human activity, has had an impact on our cities, our deserts and more. Recognising the risks of inaction in Abu Dhabi, several notable initiatives have been undertaken to reduce the atmospheric emissions of energy-consuming activities. While many of these initiatives have sought to quantify the reduction in GHG emissions, there has not been a comprehensive assessment of the positive impacts that such measures can have on public health – until now. ▶



In 2008, the Environment Agency - Abu Dhabi (EAD) and the Abu Dhabi Global Environmental Data Initiative (AGEDI) completed the first climate-change vulnerability assessment for Abu Dhabi Emirate. While several systems and sectors were screened as potentially highly vulnerable to climate change, further investigation was needed. AGEDI re-visited this study in 2011, aiming to establish a work programme that would build upon, expand and deepen the understanding of vulnerability to the impacts of climate change, as well as identify practical adaptive responses at the local, national and regional levels. In 2013, a four-year project was launched that incorporated the perspectives of over 100 stakeholders, shaping five strategic themes and a total of 12 research sub-projects, including Public Health Co-benefits of Greenhouse Gas (GHG) Mitigation.

An improvement in public health from a reduction in air emissions, such as reductions in the incidences of respiratory illnesses, cardiovascular disease, and allergies, is considered a co-benefit of GHG mitigation and is not typically accounted for in the cost of saved carbon. With continued progress in the Abu Dhabi Emirate to expand and intensify GHG-reducing activities, these public health co-benefits will similarly increase. The objective of AGEDI's Public Health Co-benefits GHG Mitigation sub-project is to improve understanding of these co-benefits and leverage policy-maker support for continued investments, while also promoting public awareness of the benefits of sustainable-development practices.

While our work is ongoing, we are in the process of developing a research model that will help answer our primary research question: Are there significant public health co-benefits in the greater Abu Dhabi City metropolitan area that are associated with the Emirate's recent and planned sustainable development policy initiatives in the power supply, transport, and industrial sectors? Though our efforts have focused on Abu Dhabi, it is our hope that this model can be adopted in other Emirates and in the region to enable further decision-making towards an environmentally sustainable future.

The sequence of calculations from emissions to co-benefits initially required the development of a comprehensive methodological framework. At the core of this framework is the current and projected data on Abu Dhabi's climate, population, vehicles, power plants, industrial facilities, air quality, and epidemiology. It is also essential that we consider two scenarios – a business as usual (BAU) scenario, which occurs before GHG mitigation, and a policy scenario for policy changes that would facilitate GHG mitigation. We explore these from 2007 until 2035.

A key aim of the sub-project is to manage the complexity of co-benefit modelling processes, so that those interested in understanding the remunerations for public health due to GHG mitigation – specialists or otherwise – can easily access the information and explore it independently. For this purpose, the Co-benefits Mapping Programme – Abu Dhabi model, or CoMPAD, was designed to respond to stakeholder input. It incorporates each of the key databases and can also model the analytical sequence of GHG mitigation policy implementation from air emissions to air-pollutant concentrations to public health co-benefits. Its functionality promises consistency in methodological approach, user-friendliness, transparency, flexibility and a focus on the Abu Dhabi metropolitan area (ADMA).

As our process prioritises stakeholder input and engagement at all times, we are currently at the stage of confirming with stakeholders that the various databases in use have accurately and reasonably reflected Abu Dhabi's BAU conditions. Following this, the information will be encoded into CoMPAD's spatial representation of public health benefits for GHG mitigation policies, at either the individual policy level or collectively via a combination of policies.



**Transport: A key emitter of GHGs in the Abu Dhabi Emirate, this sector accounted for roughly 19% of all GHG emissions in 2010**

## The seven internal databases in CoMPAD that contain information that is essential to run the model under the BAU and policy scenarios comprise:

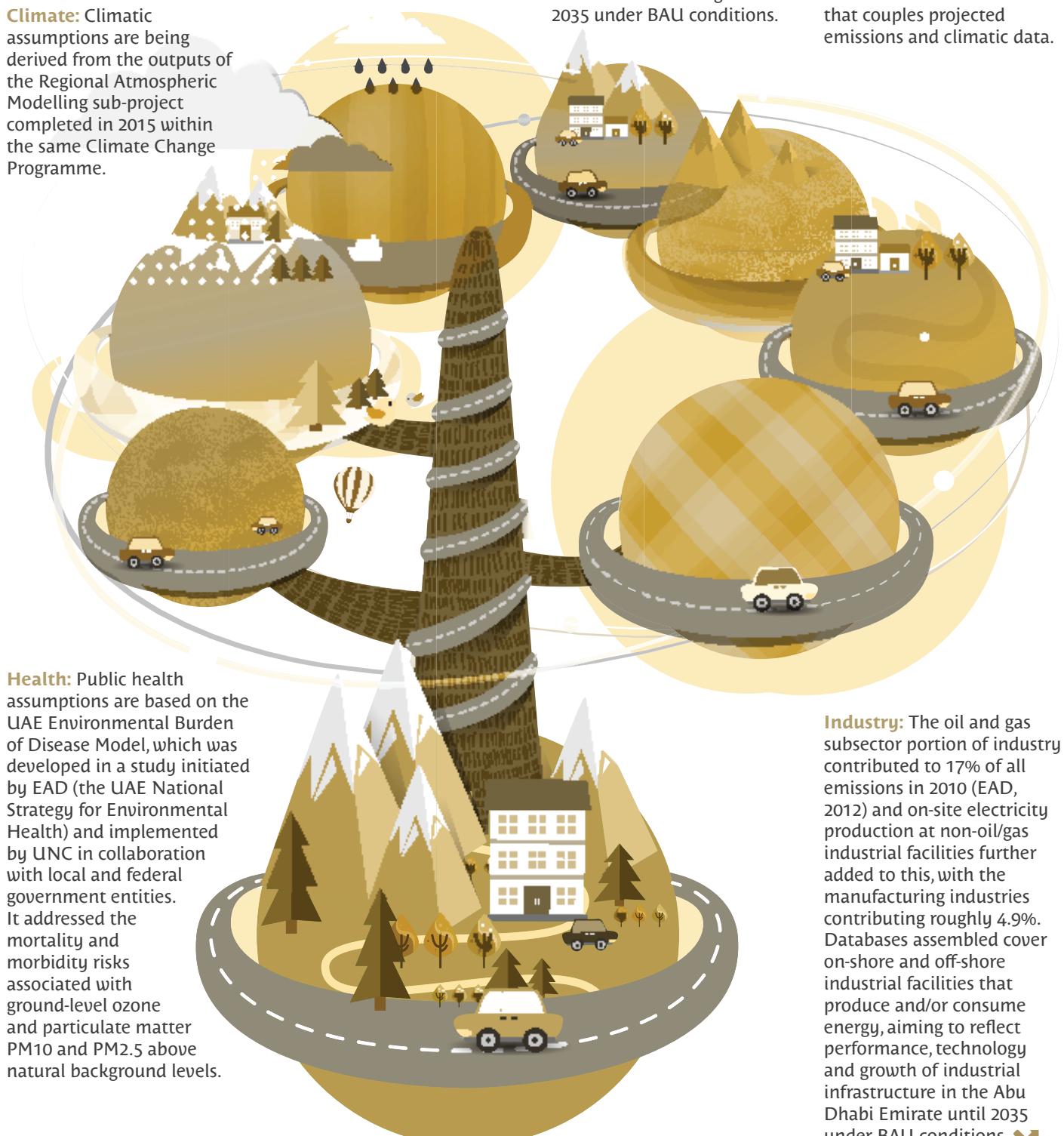
**Population:** The key starting point for the analysis of the co-benefits; the data reflects the spatial distribution of the population and the projected number of people living in the region up until 2035 under BAU conditions.

**Climate:** Climatic assumptions are being derived from the outputs of the Regional Atmospheric Modelling sub-project completed in 2015 within the same Climate Change Programme.

**Transport:** A key emitter of GHGs in the Abu Dhabi Emirate, this sector accounted for roughly 19% of all GHG emissions in 2010 (EAD, 2012). The databases cover performance, technology and growth of vehicular transport in ADMA until 2035 under BAU conditions.

**Power and water supply:** Another key GHG emitter sector, which produced approximately 31% of all GHG emissions in 2010 (EAD, 2012). Databases assembled reflect performance, technology and growth of electric and water supply infrastructure through to 2035 under BAU conditions.

**Air quality:** Assumptions on air quality for the 2007 base year are being derived from the outputs of air-quality modelling undertaken by the University of North Carolina (UNC) in EAD's 2009 Environmental Burden of Disease study. For 2035, similar data will be available that couples projected emissions and climatic data.



**Health:** Public health assumptions are based on the UAE Environmental Burden of Disease Model, which was developed in a study initiated by EAD (the UAE National Strategy for Environmental Health) and implemented by UNC in collaboration with local and federal government entities. It addressed the mortality and morbidity risks associated with ground-level ozone and particulate matter PM10 and PM2.5 above natural background levels.

**Industry:** The oil and gas subsector portion of industry contributed to 17% of all emissions in 2010 (EAD, 2012) and on-site electricity production at non-oil/gas industrial facilities further added to this, with the manufacturing industries contributing roughly 4.9%. Databases assembled cover on-shore and off-shore industrial facilities that produce and/or consume energy, aiming to reflect performance, technology and growth of industrial infrastructure in the Abu Dhabi Emirate until 2035 under BAU conditions. 

## CLIMATE CHANGE

With this in mind, there are four features in CoMPAD for running the model to conduct policy analysis reflecting user selections and assumptions:



**Policies** – 18 in particular have been codified for co-benefit analysis, based on those proposed in the draft Climate Change Strategy of Abu Dhabi (EAD, 2014).



**Targets** – the particular goals of a policy for achieving GHG reductions. Some of these can be clearly established. For example, the nuclear power policy specifies the number of nuclear reactors that are to be installed. Meanwhile, others are difficult to define for example, within the policy we encourage the purchase of high efficiency vehicles, but do not specify the actual targeted numbers of vehicles that would be purchased annually. For all policies, but especially those whose targets have yet to be fully defined in the Climate Change Strategy document, policy levers are being built into CoMPAD to offer users a range of potential and plausible targets that could be analysed.



**Summary** – synthesises all user inputs for a particular policy or set of policies for easy reference or adjustment prior to running an analysis.



**Impact** – initialises and runs an analysis for a particular policy or set of policies selected by the user, based on either default assumptions or other user-chosen assumptions.

Users are then able to generate reports in different outputs via the CoMPAD model. The Assumptions feature synthesises all user inputs that have been used to analyse a particular policy into a simple report. It also combines the impact of all user inputs on the physical performance characteristics of each of the three sectors, i.e. for the transport sector, a summary or detailed tables can be generated by vehicle and total energy, while for the power and water sector, it can be generated for electric generation and primary energy use.

The emissions feature then allows for the reporting of emission results in summaries across five different levels – per pollutant and scenario; per pollutant and sector for the BAU scenario; a detailed summary per pollutant and activity; annual emissions level per pollutant for each policy; and a detailed summary per pollutant and source for each policy.

The climate and air quality feature provides gridded outputs from climatic and air-quality modeling. Finally, the Impact feature allows for gridded estimates of the avoided mortality and morbidity risks from the implementation of the GHG mitigation policy or policies. The unit for mortality is premature deaths avoided, while for morbidity it is the healthcare facility visits avoided.

With knowledge, our leadership is empowered to make decisions that enhance environmental sustainability. As we continue our work in this field, we are confident that the Public Health Co-benefits of Greenhouse Gas (GHG) Mitigation sub-project will help decision-makers better understand the stakes and the range of options available to them. ■



In 2013, a four-year project was launched that incorporated the perspectives of over 100 stakeholders, shaping five strategic themes and a total of 12 research sub-projects

### ABOUT AHMED BAHAROON



He is the Executive Director at the Environment Agency – Abu Dhabi's (EAD) Environmental Science, Information And Outreach Sector. He is leading the support provided to EAD in its environmental education, awareness and outreach agenda and enabling public access to environmental information.

He is also the Acting Director of the Abu Dhabi Global Environmental Data Initiative (AGEDI) – an initiative of EAD and the United Nations Environment Programme (UNEP). Ahmed oversees AGEDI's mandate of facilitating access to quality environmental data that equips policy-makers with actionable, timely information, with the aim of informing and guiding critical decisions towards a sustainable future.

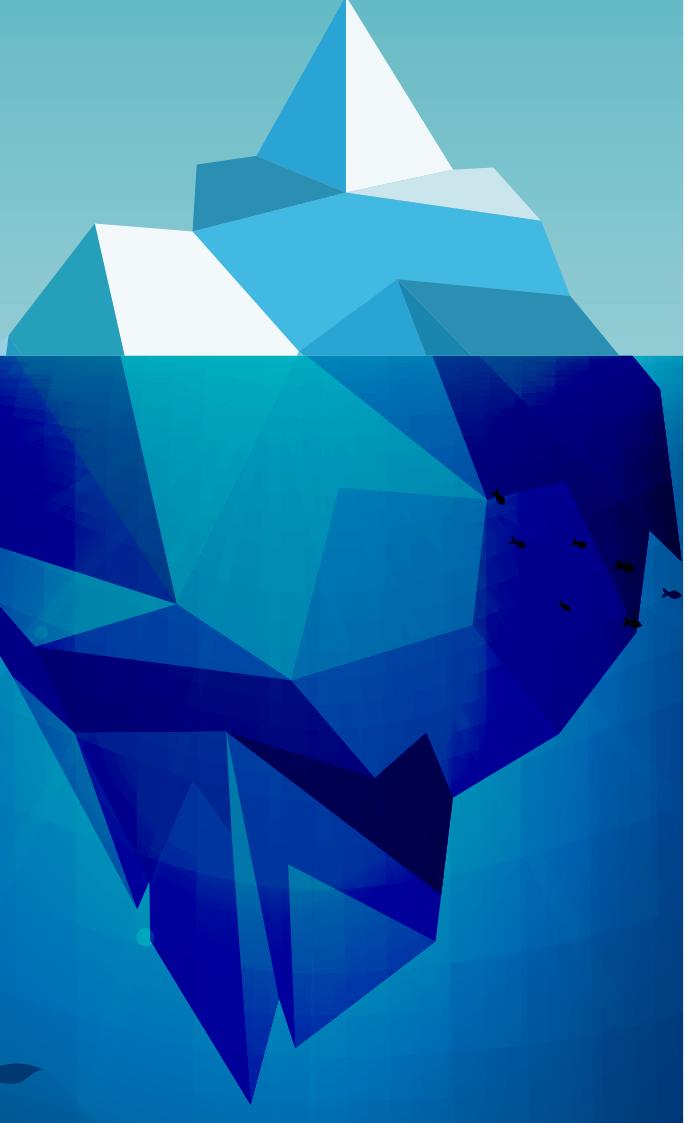
### ABOUT JANE GLAVAN



She is the Partnership Project Manager at Agedi. She has been a part of the AGEDI team since the organisation's inception and has managed a range of AGEDI's milestone projects, including the Abu Dhabi Blue Carbon Demonstration Project, the largest project of its kind worldwide. She is leading the Climate Change Programme, which is the most comprehensive study of the issue for the region. Jane also led the Biodiversity Systematic Conservation Assessment, a pioneering initiative for the region, and the State of the Environment report for Abu Dhabi.

# CARBON SHIFT

## 2016 IS EXPECTED TO BE A TURNING POINT FOR THE GULF'S ACTION ON CLIMATE CHANGE



A new era of development is emerging, with issues of climate change and energy at the top of national policy agendas the world over. At the heart of this process is a need to reshape development pathways by managing risks to and building resilience of countries' hard-won development results in an era of climate disruption and shifting dynamics in the production and consumption of energy. This is expressed at the global level this year with the launch of the new post-2015 development framework and the Sustainable Development Goals (SDGs) at the U.N. General Assembly. Unlike the previous Millennium Development Goals, the SDGs set a clear vision and set of targets on energy (Goal 7) and climate change (Goal 13).

This has clear resonance at the national level as well, with growing risks from climate change and shocks in the energy market driving countries to rethink long-standing models of development and spurring out-of-the-box thinking and innovations for risk-informed development pathways. Experiencing one of its most transformational moments in history, the Arab world is now positioned to re-think the nature of development models in the region and the risks being faced despite massive oil wealth.

The UAE stands as one important example. The Federation is one of the world's top oil exporters, with revenues having played an important role over the years in its remarkable transformation and achievements, including its diversified economy. But risks have arisen in terms of climate change and energy markets. Arab Gulf countries have some of the world's highest per capita energy consumption levels and high rates of energy consumption growth, in some countries more than twice the global average. With the diversion of energy from exports into local consumption, this results in a drain on public revenues at the base of various development goals for current and future generations, while also generating some of the world's highest per capita carbon emissions. ↗



**The Arab world is now positioned to re-think the nature of development models in the region and the risks being faced despite massive oil wealth**



By Dr. Kishan Khoday  
& Dr. Stephen Gitonga

Reducing the carbon intensity of development has thus arisen as a top government priority, as a means of creating fiscal space to achieve and sustain intended social and economic development goals for current and future generations, while also registering important environmental co-benefits from reduced carbon emissions. It is also an opportunity for the UAE to set the base for a new clean-energy economy while opening opportunities for global collaboration to engage new capital and knowledge.

2015 is a critical year in this regard, with the UAE having enacted landmark new policies to shift to gasoline price deregulation with the resultant goal of fossil-fuel subsidy reductions. This is designed to rationalise the intensity of energy consumption growth, with reduced subsidies expected to affect petrol consumption in the transport sector. Prices at the pump for filling automobiles are expected to rise as will electricity bills for homes and buildings, with USD billions expected to be saved in state budgets each year. Meanwhile, fossil-fuel subsidy reductions are expected to lead to reduced intensity of energy consumption, creating a price incentive for a more efficient use of energy.

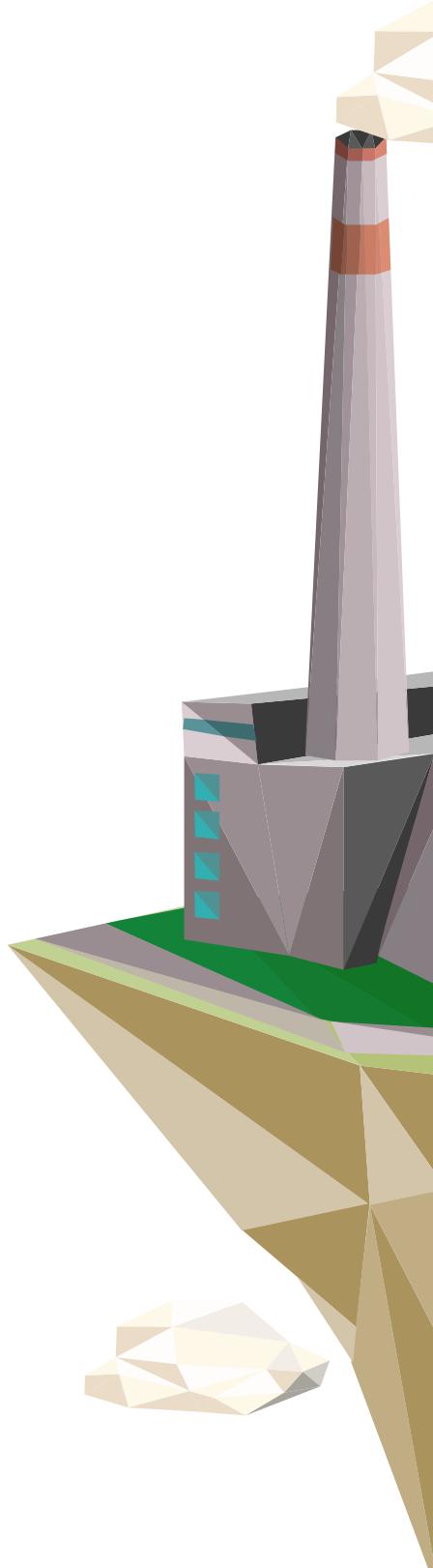
Among other development priorities, a strategic opportunity exists to reinvest a share of the public funds saved into creating a new clean-energy economy in UAE. New finance can help scale-up ongoing efforts to craft an innovative knowledge-economy in the UAE around the local development of clean-energy technologies, which in turn will likely result in the emergence in coming years of a new high-tech sector of value for the local economy and contribute to the potential future role of the UAE as a hub for trade and investment in clean energy. New investments in a clean-energy economy would also help minimise future risks to the UAE economy. Re-investing a share of the saved fossil-fuel subsidy allocations in the scale-up of the clean-energy sector would complete the circle and set the foundation for a true shift in carbon policy.

Equally critical are the lessons of the UAE's fossil-fuel subsidy reforms for achieving global goals. The recently issued Addis Ababa Action Agenda (AAAA) on Financing for Sustainable Development placed important focus on the value of domestic resources and innovative financing for development goals, including through fiscal innovation around subsidies and other systems, while still addressing the needs of the most needy and poor in society. Meanwhile, many engaged in the debate over a new global climate agreement have also placed emphasis on the potential of fossil-fuel subsidy reforms to significantly reduce global carbon emission levels.

The 2015 Islamic Declaration on Climate Change, another landmark call to action this year by religious leaders around the world, has taken it one step further by placing the issue of climate and energy policy in the Arab region as an ethical issue, beyond economic, social and environmental dimensions. While many countries globally have been taking action to enhance energy subsidy systems, not many are major oil exports like the UAE. By showing strong leadership to see through the implementation of its new regulations, the UAE has the opportunity to create a new vision on ways resource-rich economies can take action on the local dimensions of the post-2015 development agenda, offering a new vision for reshaping the long-standing social compact in the Arab region around energy and development. ■



**Re-investing a share of the saved fossil fuel subsidy allocations into scale-up of the clean-energy sector can complete the circle and set the foundation for a true shift in carbon policy**





**It is also an opportunity for the UAE to set the base for a new clean-energy economy while opening opportunities for global collaboration to engage new capital and knowledge**

**ABOUT  
DR. KISHAN  
KHODAY**



He serves as Regional Team Leader for Climate Change, DRR & Resilience with the United Nations Development Programme (UNDP) in the Arab Region. He has served with the United Nations for over 15 years leading local cooperation in China, India, Indonesia and Saudi Arabia. He now leads UNDP's regional efforts in the Arab region, with over \$100 million of projects on climate change, energy and environment across the region. UNDP is the UN's largest provider of assistance in the area of climate change, with over \$1.6 billion of projects around the world.

**ABOUT  
DR. STEPHEN  
GITONGA**



He serves as Regional Sustainable Energy Specialist with the United Nations Development Programme (UNDP) in the Arab region. Stephen has over 25 years of experience in areas of climate change and energy with the United Nations, having led many UNDP global efforts in recent years before joining UNDP's regional team. This includes his lead role in forging partnerships under the global Sustainable Energy for All Initiative and leading UNDP's efforts to support decentralized energy solutions.

# IHC ENVIRONMENTAL INITIATIVES



ARTICLE

By  
H.E. Shaima Al Zarooni

The International Humanitarian City (IHC) is the Dubai-based leading global humanitarian hub, acting as a logistics centre for the distribution of humanitarian aid, with warehouse space of 52,000 square metres. It has a broad geographical reach for efforts from the MENA region into Asia, the Americas and Africa. The IHC has humanitarian digital-data content generation capabilities and a diverse membership base, including nonprofit organisations, intergovernmental organisations, UN agencies and commercial entities. In early 2015, the IHC launched a six-year strategy towards 2021, focusing on four main humanitarian pillars:

connect, innovate,  
partner and lead.



In order to position the IHC as a global centre of research, development and thought leadership in the humanitarian field, the IHC's focus within the sector revolves primarily around innovation and knowledge, through the creation of a think-tank, developing a global online humanitarian portal and supporting start-ups focusing on innovation applicable to humanitarian aid.

According to UN statistics, three quarter of the worlds' population will live in cities by 2050

Several initiatives go into fostering innovation, such as encouraging local and international humanitarian organisational engagement through global online knowledge-sharing, the development of an experience-sharing portal and developing innovation labs to drive entrepreneurship. The IHC also launched a Humanitarian Challenge to steer youth creativity and offer empowerment, with a prize of AED 1 million.

According to UN statistics, three quarter of the worlds' population will live in cities by 2050<sup>1</sup>. Given this, the IHC is committed to providing support in the creation of a preferable, sustainable environment by closing the gaps in water provision, transport, food security and spatial planning. While sustainability has many definitions, balancing environmental protection and social responsibility with a healthy economy over time plays a significant role in the successful creation of sustainable communities and the IHC plays a role in engaging and inspiring both public and private organisations to become better stewards of the environment. The IHC's optimal objective is to establish regional leadership as regards social responsibility.

The IHC puts Dubai's expertise in transport and logistics to work for aid agencies as they reach out to help the victims of crises and families whose lives are threatened by hunger and poverty. The IHC also developed the First Global Humanitarian Impact Fund in order to channel private-sector funding towards sustainable humanitarian projects and effective emergency response, empowering younger generations and women in particular.

Empowering youth and bringing innovative ideas into reality is an important element in developing sustainable, creative and innovative solutions for a viable environment. One of the recent projects supported by the IHC was the Carbon Ambassador's sustainable bus stops project, where the IHC provided construction space to the consolidated construction company that worked on the project. The bus stops were created out of used 20-foot shipping containers supplied by DP World. These structures are completely functional and self-sustaining and have now been put to good use in a project that exemplifies making the most of waste.

The Carbon Ambassadors programme is a unique and innovative project that contributes to environmental sustainability by rationalising the consumption of resources, and the programme is in accordance with the vision of H.H. Sheikh Mohammed Bin Rashid Al Maktoum, UAE Vice-President Prime Minister and Ruler of Dubai. In his paragraph to: The IHC is proud of the Carbon Ambassadors and the forward-thinking attitude displayed in the challenge of developing sustainable bus stop stations.

## ABOUT H.E. SHAIMA AL ZAROONI



She is the CEO of the International Humanitarian City (IHC). Prior to joining the IHC in 2011, Shaima worked for the Office of H.R.H. Princess Haya Bint Al Hussein, wife of H.H. Sheikh Mohammed Bin Rashid Al Maktoum, Vice-President and Prime Minister of UAE and Ruler of Dubai. She also worked in the Office of H.H. Sheikh Mohammed Bin Rashid Al Maktoum at the Ruler's Court, prior to joining the Executive Council of Dubai.

The IHC is keen to support further innovative projects and follow the recommendations of the Government Summit 2015, which is compatible with the IHC strategy 2015-2021 and innovation development, which can ultimately lead to real and positive change across the globe. ■



FOOTNOTES

<sup>1</sup> World Urbanization Prospects, <http://esa.un.org/unpd/wup/Highlights/WUP2014-Highlights.pdf>

# THE ZERO CARBON POLICE FORCE INITIATIVE



**By H.E. Expert Major  
General Khamis Mutar  
Khamis Al Muzainah**

**In efforts that go above and beyond standard policing, Dubai Police launched its Zero Carbon Police Force initiative in November 2014. Since then, the force has been working closely with the Dubai Carbon Centre of Excellence to study current activities and find solutions and alternatives that are in line with international standards to achieve sustainability. Jointly, Dubai Police and Dubai Carbon are developing initiatives for energy efficiency, fuel saving and carbon offsetting, which will generate a carbon-neutral profile for Dubai Police – the first police force in the world to achieve this feat.**

The collaborative project revolves around two main areas. The first is capacity-building in the form of training and knowledge-sharing. Initially, focal points within different General Departments at Dubai Police were selected and given the title "Carbon Officers" during the project. The Carbon Officers attended an introductory three-day training workshop on carbon footprints and climate change, which led on to user training on Energy Management Systems (EnMS) conducted by the United Nations Industrial Development Organisation (UNIDO), in conjunction with Dubai Carbon, who organised the training. It is the first of its kind in the UAE. The aim is to empower the Carbon Officers to manage the carbon footprint and energy consumption across Dubai Police departments and spread knowledge amongst peers, so that Dubai Police can make a significant contribution to the Dubai Government's 30% energy-reduction goal by 2030.

Naturally, the knowledge-sharing aspect of the project extends beyond training and workshops. Dubai Carbon has focused its efforts in countless discussions with the Carbon Officers, to

facilitate awareness within the force and educate on the importance of carbon-emission reductions and the methodology used to calculate the carbon footprint.

Together, Dubai Police and Dubai Carbon are working on a comprehensive plan for carbon-emission reductions, setting carbon-reduction strategies in line with government directives and Dubai Police's capabilities. This includes exploring emission sources and investigating opportunities as regards renewable energies, conservation measures and investment in offsetting through international carbon credits, to name just a few. The initial carbon footprint calculations and plans lay the foundation for a system for Dubai Police's future data collection and carbon-footprint calculations, through the internationally recognised Monitoring, Reporting and Verification Framework.

Ultimately, the partnership between Dubai Police and Dubai Carbon will effectively contribute to the sustainable, green growth of Dubai and the UAE economy and promote Dubai Police as a world-leading force in terms of efficiency and environmental initiatives. ■



**Dubai Police and Dubai Carbon are working on a comprehensive plan for carbon-emission reductions, setting carbon-reduction strategies in line with government directives and Dubai Police's capabilities**



initiatives (...) will generate a carbon-neutral profile for Dubai Police – the first police force in the world to achieve this feat

### ABOUT H.E. EXPERT MAJOR GENERAL KHAMIS MUTAR KHAMIS AL MUZAINAH



H.E. is the Commander-in-Chief of Dubai Police. He joined the Force in 1983. In 2013, he was appointed by H.H. Sheikh Mohammed bin Rashid Al Maktoum, Vice-President, Prime Minister and Ruler of Dubai as the Commander-in-chief of Dubai Police. Prior to his appointment as Commander-in-chief, he served as the Deputy Commandant General of Dubai Police.

# CLIMATE CHANGE - WHY THE UAE MUST ACT

## HOW THE UAE COULD BE IMPACTED BY CLIMATE CHANGE



By Paola Ferreira  
and Ahmed Baharoon

The Intergovernmental Panel on Climate Change (IPCC), the most reputable information source on the topic of climate change, states that “Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and oceans have warmed, the amounts of snow and ice have diminished, and the sea level has risen.” (IPCC, 2014). Furthermore, it iterates that the period between 1983 and 2012 was likely the warmest 30-year period in the last 1,400 years in the Northern hemisphere. Historically, evidence that the Earth’s climate has changed dramatically is unequivocal.

Sea surface temperatures are projected to increase in the Gulf, in a range between 1.7°C and 2.8°C



The IPCC reports, however, have very little information about the projected impacts of climate change in the Arabian Gulf. Therefore, the Local, National, and Regional Climate Change Programme (LNRCCP) launched by AGEDI in 2013 was designed to develop more regional and country specific modelling of climate change as a follow-up to an initial EAD study from 2008. The recent research provides a unique assessment of the impacts of climate change in the UAE and the region under two future scenarios – one assuming a business-as-usual trajectory of global greenhouse-gas (GHG) emissions, the other more positive option assuming stabilisation of GHG emission concentrations in the atmosphere by 2100 (AGEDI et al, 2015a).

These assessments were done utilising high-resolution Regional Ocean and Regional Atmospheric models, which provide a precise understanding of how the Arabian Gulf conditions may change at different locations due to climate change under different GHG trajectory scenarios (AGEDI et al., 2015; AGEDI et al., 2015). Both regional models were customised and scaled down from IPCC-approved global models, validated with regional and local data,<sup>1</sup> and have the capacity to predict with a high level of resolution and confidence the possible impacts of climate change at the regional and local level. This ground-breaking information must be utilised to inform decisions regarding climate change.

The main conclusions of these regional modelling exercises are, so far, quite striking. They project various climatic variables including rainfall, temperature, humidity and wind for the ocean modelling and surface temperature, salinity and sea-level rise for the regional atmospheric modelling. According to the summary reports, “the results show a warmer and wetter climate in the region compared to historical trends” (AGEDI et al., 2015) and also predict the occurrence of extreme cyclonic events and significant changes in temperature and salinity, as well as mixing processes and circulating patterns in the Gulf. 



“

Annual average rainfall would increase in various locations of the Arabian Gulf, with some places experiencing increased precipitation and some decreased precipitation

### Some of the most salient impacts are summarised below<sup>2</sup>:

Sea surface temperatures are projected to increase in the Gulf, in a range between 1.7oC and 2.8oC. The model predicts in detail the areas that will be affected and predicts the temperature change;

Salinity is also expected to vary, with increasing and decreasing effects in different locations of the Gulf;

Sea-level rise was assessed throughout the Gulf only taking into account what is called the dynamic sea level (DSL). The current projections are of only between 2.7cms to 5cms in different Gulf locations. Nevertheless, due to regional modelling limitations, dynamic sea-level rise accounts for the smallest contributor to sea-level rise and does not include 90% of the other two main influencing factors, due to global thermal expansion and deglaciation process. Therefore, these initial estimates are revealing a minor portion of the potential sea-level rise. AGEDI has plans to complement the research with the other two components, which will provide a more realistic assessment;

Annual average rainfall would increase in various locations of the Arabian Gulf, with some places experiencing increased precipitation and some decreased. For example, there is a projected increase in precipitation in the Arabian Gulf and the Hajar Mountains during the winter, but decreased rainfall over portions of Oman and Saudi Arabia;

Land Temperature is expected to increase across the region by around 2°C to 3°C, both in summer and winter months;

Humidity change is projected to be higher in the summer months and by 2060-79 will be a striking 10% higher than the historic period of 1986-2005 over the whole Arabian Gulf, with even higher humidity levels in the UAE;

Extreme events are also expected to occur under these projections, in particular intense cyclones that originate in the Arabian Sea, which share the characteristics of tropical typhoons.

In addition to the modelling work, the LNRCC programme also addresses critical research at the UAE level, analysing the links between these climatic impacts and food security, as well as assessing the potential impacts on terrestrial and marine biodiversity in the regional Arabian Gulf.

Not many countries or decision-makers are privileged to have such specific information. Therefore, decision-makers should use this information on the potential effects of climate change in the UAE and the region to systematically assess the risks that could occur if climate change continues to materialise. According to the IPCC “rising rates of warming and other changes in the climate system, accompanied by ocean acidification, increase the risk of severe, pervasive and in some case irreversible detrimental impacts”(IPCC, 2014).

It is therefore advisable that decision-makers nationally take the latest science into account, to undertake a thorough risk assessment for the country. This is particularly relevant given the already extreme climatic conditions of the UAE.

The assessment should follow IPCC guidance and evaluate the largest possible range of impacts, including low probability outcomes with big consequences (IPCC, 2014). For example, the potential of extreme weather events, like the anomaly of the projected cyclones coming out of the Arabian Sea, should be taken seriously and scrutinised to assess risk. Other less dramatic results of the modelling should be also considered to prepare the country properly. For example, results so far indicating increased humidity and land temperature show there will be an escalation in cooling demand that in the future might strain cooling infrastructure if not properly accounted for. Likewise, increased salinity and water temperatures in the Gulf might affect water desalination infrastructure. Once sea-level rise is properly assessed, a detailed risk assessment on vital coastal infrastructure needs to be performed, given the coastal nature of the UAE. Equally important, marine and terrestrial biodiversity are already facing many threats due to the effects of rapid infrastructure development, amongst others. These threats could be amplified due to climate change. The regional models can produce valuable results to assess how to mitigate these impacts through integrated land-use planning and protected areas, for example.

It is therefore crucial that the UAE decision-makers take these findings as a starting point to assess risks at various levels across biodiversity and infrastructure and develop and implement adaptation measures for the country. This process has already started at the GCC level through the United Nations Environmental Programme (UNEP)'s Lima Adaptation Knowledge Initiative, which is focused on prioritising adaptation knowledge gaps. This first step needs to evolve into a full risk assessment and delineating adaptation plans for the UAE and the region.



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Alam Tanzeed, Closing the Abyss – WWF, 2015.

Intergovernmental Panel on Climate Change -IPCC. Climate Change 2014- Synthesis Report – Summary for Policy makers, 2014.

In the lead up to the UNFCCC Conference of the Parties in Paris, the UAE can play a leadership role, highlighting the importance of having an ambitious global deal to the other Gulf countries. More urgent action from the region would help create the necessary momentum to close the pre-2020 gigatonne gap<sup>3</sup> and ensure that the planet is on its way to reducing GHG emissions by 80% by 2050 (Alam, 2015).

Domestically, the UAE also needs to do its share to reduce GHG emissions, as its per capita emissions were four times higher than the world average in 2011<sup>4</sup>. Increasing the level of ambition of renewable energy, starting with the implementation of current targets, which is now economically viable, should do this. Likewise, energy and water efficiency should be optimised, taking advantage of the unique technical and economic potential of demand side management.

While the modelling studies that have been completed provide a strong foundation for climate-change mitigation initiatives, there is still much to be done – and the need to develop an integrated and expanding pool of environmental data on this issue is pressing.

The AGEDI Climate Change Programme, the first of its kind in the Arabian Gulf, is a strategic and timely initiative that will help regional leaders, innovators and decision-makers better understand the stakes and the range of options available. Through close collaboration with stakeholders, the programme offers an important basis upon which to develop high-level, coordinated decision-making about the critical adaptation to climate change.

The UAE must act on these facts and the moment to act is now. ■



#### FOOTNOTES

- 1| Validation of the models is crucial because it allows the model to be calibrated and increases the level of confidence to accurately simulate future climate changes at different scales (Regional Atmospheric Modelling- Draft – Policymaker Summary for AGEDI's LNRCCP, AGEDI, NCRA, Climate Change Research Group, 2015)..
- 2| All the model projections summarised below are taken from the following draft reports that AGEDI is leading on: Regional Atmospheric Modelling- Draft – Policymaker Summary for AGEDI's LNRCCP, AGEDI, NCRA, Climate Change Research Group, 2015; and Regional Ocean Modelling- Draft – Policymaker Summary for AGEDI's LNRCCP, AGEDI, NCRA, Climate Change Research Group, 2015..
- 3| First reported in the UNEP report 'The Emissions Gap Report 2010', the gigatonne gap is the difference between the greenhouse gas 'budget' that the world needs to stick to by 2020 and the actual emissions we're on course to produce. A gigatonne is a billion tonnes and the world is on course to emit as much as 53 gigatonnes of CO<sub>2</sub> (or the equivalent in other greenhouse gases) per year by 2020. The scientists' recommended upper limit is 40 gigatonnes per year.
- 4| World Bank Database: <http://bit.ly/1G1XQ5K>

## ABOUT PAOLA FERREIRA



She is the Conservation & Climate Director of Emirates Wildlife Society in association with WWF (EWS-WWF). She has led the development of the EWS-WWF five-year conservation strategy that focuses on climate and energy and biodiversity conservation. She has a degree in Civil

Engineering and is a biologist, as well as holding an MSc in Technology and Policy from MIT.

## ABOUT AHMED BAHAROON



He is the Executive Director at the Environment Agency – Abu Dhabi's (Ead) Environmental Science, Information And Outreach Sector. He is leading the support provided to EAD in its environmental education, awareness and outreach agenda and enabling public access to environmental information.

He is also the Acting Director of the Abu Dhabi Global Environmental Data Initiative (AGEDI) – an initiative of EAD and the United Nations Environment Programme (UNEP). Ahmed oversees AGEDI's mandate of facilitating access to quality environmental data that equips policy-makers with actionable, timely information, with the aim of informing and guiding critical decisions towards a sustainable future.

# MEETING OF THE PARTIES



THE MONTREAL  
PROTOCOL COUNTS AS ONE  
OF THE SUCCESS STORIES  
OF THE INTERNATIONAL  
ENVIRONMENTAL  
NEGOTIATIONS



By Eng.  
Othaiba Al Qaydi



The efforts made by the UAE in contributing to the global preservation of the ozone layer, were crowned by hosting the 27<sup>th</sup> Meeting of the Parties to the Montreal Protocol in 2015

The Vienna Convention for the Protection of the Ozone Layer is a non-binding international agreement developed to address the problem of stratospheric ozone depletion. It was adopted in 1985 and entered into force on 22 September, 1988. In 2009, the Vienna Convention became the first convention of any kind to achieve universal ratification. The objectives of the convention were for parties to promote cooperation by means of systematic observations, research and information exchange on the effects of human activities on the ozone layer and to adopt legislative or administrative measures against activities likely to have adverse effects on the ozone layer.

The Vienna Convention did not require countries to take concrete action to control ozone-depleting substances. Instead, in accordance with the provisions of the Convention, the countries of the world agreed the Montreal Protocol on Substances that Deplete the Ozone Layer under the Convention to advance that goal.

The Montreal Protocol on Substances that Deplete the Ozone Layer is a landmark international agreement designed to protect the stratospheric ozone layer. The treaty was originally signed in 1987 and substantially amended in 1990 and 1992<sup>1</sup>. The Montreal Protocol stipulates that the production and consumption of compounds that deplete ozone in the stratosphere are to be phased out. Scientific theory and evidence suggest that, once emitted to the atmosphere, these compounds could significantly deplete the stratospheric ozone layer that shields the planet from damaging UV-B radiation.

The UAE joined the Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer in 1989. It also supported the four amendments of the Montreal Protocol, namely the London Amendment in 1990, the Copenhagen Amendment in 1992, the Montreal Amendment in 1997 and the Beijing Amendment in 1999.

Since the UAE's accession to the Vienna Convention and the Montreal Protocol, the UAE has developed a set of measures to meet its obligations pursuant to the Convention and the Protocol. These actions focused on the development of legislation and controls related to the regulation of substances that deplete the ozone layer.

The UAE through its own efforts was able to fulfill its obligations in achieving the total ban of CFC's and Halons in 2010.

The UAE has developed a national programme to phase out HCFCs compounds used in the refrigeration and sponge industry. Under this programme it froze the consumption of HCFCs compounds at the beginning of 2013, in preparation for the gradual reduction of these compounds by 2015 down to a final ban in 2040 and ordered all agencies that deal with equipment and compounds that deplete the ozone layer of the need to obtain official permission for each import transaction of any of the controlled substances. The UAE has issued decisions related to the implementation of the provisions of the Montreal Protocol, the most recent of which was Cabinet decision No.26 for 2014 with respect to the national system for ozone-depleting substances.

The efforts made by the UAE in contributing to the global preservation of the ozone layer were crowned by hosting the 27<sup>th</sup> Meeting of the Parties to the Montreal Protocol in 2015. The UAE is keen to increase international and local community awareness on the protection of the ozone layer, as well as to mitigate the effects of climate change and develop and implement innovative solutions to protect the environment, underscored by the UAE Vision 2021. ■

**ABOUT  
ENG. OTHAIBA  
AL QAYDI**



She is the Director of the Chemical Department in the UAE Ministry of Environment and Water, with more than 10 years of professional experience. Her responsibilities include developing policies and standards to protect the country's environment and developing chemical-management policies for safe handling and treatment.



1| Note there have been 8 revisions in total since 1990



# CLEAN & ALTERNATIVE ENERGY

**HIS EXCELLENCY  
SAEED MOHAMMED AL TAYER**

VICE CHAIRMAN, DUBAI SUPREME COUNCIL OF ENERGY,  
MANAGING DIRECTOR AND CHIEF EXECUTIVE OFFICER  
DUBAI ELECTRICITY AND WATER AUTHORITY



In the span of just a few years, the UAE has established itself as the regional leader in renewable energy technologies.

We were among the first countries in the Middle East and the first in the Gulf to recognise the important implications of renewable energy for the security of our energy supply. We took risks and studied and implemented new technologies that were not tested on a big scale in the region before.

Earlier this year, all eyes, not only within the region but also globally, were on Dubai. The Emirate showed that given the right conditions, solar power can be a financially-attractive and competitive option with the breakthrough USD 5.4 cents per kilowatt power purchase agreement.

However, we do not intend to rest on our achievements, we intend to make more, as does the rest of the UAE. The big announcements for the year to come will be not only about large utility-scale projects. Small-scale generation is just as important. We have made it possible for Dubai's residents and tenants to quickly add new capacity, while also increasing local renewable energy expertise and business opportunities.

I trust that our achievements laid out in this report will serve to inspire others who are looking to enjoy the social, environmental and, increasingly, economic advantages of renewable energy technologies. As Dubai embraces renewable energy, this will support a brighter sustainable future for us all, for generations to come.

# LEADING RENEWABLE ENERGY DEVELOPMENT IN THE MIDDLE EAST

THE UAE IS ACTIVELY  
PURSUING AN ENERGY  
MIX INCLUDING  
RENEWABLES FOR ITSELF  
AND ITS NEIGHBOURS



By  
Dr. Ahmad Belhoul



**With the world's population on target to reach nine billion by 2050, nations will need to explore new and innovative solutions to sustain their citizens' increasing demand for energy. If rising energy demands are left unchecked, they could outstrip global supply.**

How can we as a planet produce the clean and safe power that we need to ensure economic security, while protecting our environment for future generations? This question has spurred global interest in renewables, which offer sustainable energy solutions, while protecting against supply disruptions and price volatility. And as a result, the International Energy Agency reports that renewables are globally the fastest-growing energy segment.

Blessed with the eighth-largest reserves of hydrocarbons on Earth, the United Arab Emirates has leveraged its longstanding energy leadership and now plays a pivotal role in the development of clean, safe and increasingly affordable renewable energy worldwide. The UAE's leadership is critical because economic development is not possible without reliable sources of energy.

The world's limited supply of hydrocarbons places a responsibility on the UAE to leverage its energy expertise in developing alternative sources to complement the world's energy portfolio. In recent years, the UAE has established a strong track record with successful deployment of renewables locally, regionally and worldwide.

Masdar has played a central role in implementing the UAE's renewables strategy. With a portfolio of 1.5 gigawatts of renewable energy under construction, the company began with the installation of a 10-megawatt (MW) solar photovoltaic plant. The largest PV plant in the region when it was inaugurated, it provides power to Masdar City, the 6km<sup>2</sup> sustainable urban development located minutes from Abu Dhabi International Airport. 170kms southwest of Abu Dhabi, the company has built the 100-MW Shams 1 concentrated solar power (CSP) plant in Abu Dhabi's Al Gharbia region. One of the largest CSP plants in the world, the 2.5km<sup>2</sup> site generates sufficient clean electricity to power 20,000 homes. 



**Masdar City uses  
40% less energy and  
water than similar  
buildings in Abu Dhabi**

The UAE's committed and proactive leadership in the adoption of renewables comes at a time when the cost of clean energy is falling dramatically. Investment is on the increase in the UAE as companies take advantage of competitive pricing and economies of scale. For example, the Dubai Electricity and Water Authority recently closed financing on a 200MW solar plant with an agreed price of less than USD 0.06 per kilowatt-hour, one of the lowest to date. Expected to be fully operational in 2017, this is the largest phase of what will eventually be the USD 3.3 billion Mohammad Bin Rashid Al Maktoum Solar Park, which will be instrumental in achieving Dubai's long-term renewable energy goals.

In addition to developing new energy sources, we must consume energy more efficiently. This is the core mission of Masdar City, a sustainable urban development that demonstrates how to accommodate growing populations with less energy, water and waste. Masdar City uses 40% less energy and water than similar buildings in Abu Dhabi and is home to Siemens Middle East headquarters, rated LEED Platinum for its efficiency and environmental credentials.

Finding ways to produce or consume energy more cleanly and efficiently requires research and innovation. Aimed at resolving fundamental challenges, the Masdar Institute of Science and Technology is helping move the UAE clean-technology sector ahead. Energy storage is one of the challenges and the Institute is partnering with the Massachusetts Institute of Technology to advance new technologies, with the project set for completion in 2017.

Equally important is Masdar Institute's mission to cultivate the next-generation leaders of the renewable energy sector. The Institute's students are gaining knowledge and insights that will ensure they are ready to tackle future challenges with innovative solutions, as the clean-technology sector matures.

In another development that looks as much to the present as it does to the future, Masdar has launched the Solar Hub to provide international solar-power companies with a platform to test and optimise existing and next-generation solar technologies.

Such developments have been possible because of decisions the UAE's visionary leadership made in developing a holistic energy strategy. The Abu Dhabi and Dubai Governments were amongst the first in the region to set renewable energy targets for 2020 and 2030, but these goals have been matched by new policies to conserve fossil fuels – most notably the recent change in policy that ended fuel subsidies.

The shift towards market pricing for vehicle fuel is important, not just for economic reasons, but also because it will drive consumer behaviour. As people come to terms with paying market rates for fuel, they will acquire a new mind-set, one that puts a greater value on sustainable, affordable energy. This will encourage investment in more innovative energy-efficient technologies, while increasing interest in fuel-efficient cars, including hybrids and electric vehicles (EVs). While the government's programme to convert vehicles to compressed natural gas has reduced emissions significantly, EVs charged by renewables will have even lower emissions.

Such commitments, made by the UAE's leadership, are largely the reason behind the decision of the International Renewable Energy Agency (IRENA) to establish its headquarters in Abu Dhabi's Masdar City. The first intergovernmental organisation headquartered in the Middle East, IRENA has become a trusted partner of the UAE's leadership as nations throughout the Gulf region, and the world, seek new solutions for diversifying their energy portfolios.

The possibilities for collaboration are already evident: Masdar Institute and IRENA recently worked together on the Global Atlas for Renewable Energy, which provides countries with the expertise and financial support to evaluate their maximum domestic renewable energy potential.

The UAE's leadership has been instrumental in facilitating renewable energy development throughout the Middle East and North Africa. By delivering many first-of-a-kind projects, Masdar has been a catalyst for the expansion of renewables throughout the region. In 2013, Masdar launched the Sheikh Zayed Solar Power Plant in Mauritania, its first, which meets 10% of the country's electricity needs. Additional projects in the Middle East, Afghanistan and the South Pacific are electrifying communities while reducing dependence on expensive diesel imports.

The UAE's interest in renewables goes beyond energy from the sun, as wind power is emerging as an investment opportunity. Later this year, the Tafila Wind Farm, a project in which Masdar has invested and provided technical support, will begin producing power in Jordan. Lacking hydrocarbon resources, the Kingdom has long relied on expensive imported diesel fuel for power generation. This 117MW wind farm will reduce the need for diesel while adding 3% to the country's power-generating capacity. Meanwhile, south of Abu Dhabi, in Oman's Dhofar region, a 50MW wind farm delivered by Masdar will be the first utility-scale wind farm within the GCC.



Thanks to a confluence of global factors, including falling costs, innovative thinking and growing environmental concerns, the time for renewable energy has arrived. The UAE, through Masdar in particular, has been a first-mover on renewable energy not only in the Middle East, but also across the globe. These advancements in renewable energy in the UAE, Middle East and the world are having a meaningful impact as they stimulate economic and social development while diversifying energy supplies to ensure safe and affordable access to electricity for millions of people. ■

ABOUT  
**DR. AHMAD BELHOUL**



He is the Chief Executive Officer of Masdar. Prior to becoming Masdar's chief executive, he was the CEO of strategy and tourism sector development at Dubai's Department of Tourism and Commerce Marketing. He has also worked as Vice President at Mubadala Development Company and with the management consulting firm, McKinsey & Company. Since 2013, he has served on the board of Emirates Development Bank.



INTERVIEW:  
**H.E. SAEED  
MOHAMMED  
AL TAYER**

**Managing Director & CEO,  
Dubai Electricity &  
Water Authority**

#SolarRevolution



## Q1: What is DEWA's Shams Dubai Initiative?

**H.E. Saeed Mohammed Al Tayer:** Shams Dubai, or the Distributed Renewable Resources Generation (DRRG) programme as it is also known, regulates the generation of distributed solar energy and encourages building owners to install photovoltaic solar panels on the rooftops to generate solar power, and connect them to DEWA's power grid. The electricity generated is primarily used onsite and the surplus is exported to DEWA's grid. This encourages the use of renewable energy, increases its share in electricity production, and contributes to diversifying the energy mix.

This is the first of three initiatives that DEWA is undertaking to achieve the Smart Dubai initiative to transform Dubai into the smartest city in the world, which was announced by H.H. Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai.

Shams Dubai is also intended to support Executive Council Resolution Number 46 of 2014, issued by H.H. Sheikh Hamdan bin Mohammed bin Rashid Al Maktoum, Crown Prince of Dubai and Chairman of the Dubai Executive Council, to enable customers to install photovoltaic panels to generate electricity from solar power in buildings, and connect them to DEWA's grid. This smart initiative supports the Dubai Plan 2021 and the Dubai Integrated Energy Strategy 2030, to develop sustainable energy projects in Dubai.

## Q2: What support are you providing to encourage the use of solar panels?

**H.E. Saeed Mohammed Al Tayer:** With the passing of Council resolution number 46 of 2014, DEWA has been actively able to promote and the uptake of solar panels by commercial and residential building owners and tenants. DEWA is working with consultants, contractors and Energy Services Companies (ESCOs) to provide the support required for the inclusion of photovoltaic solar panels on commercial and residential buildings.

This includes the support provided to ESCOs by DEWA's super ESCO, Etihad Energy Services, to certify them to carry out the necessary work to support the installation of solar panels. DEWA has also published the standards required for solar panels for contractors and consultants to ensure that all work is carried out according to international best practices.

DEWA has put in place an easy and transparent framework for interested customer to install and connect solar panels, but it's entirely up to them to take a decision to make the required investment to generate their own clean energy and exchange it with DEWA network under the net metering scheme described. 



### Q3: Who are the key players of the initiative, and their role?

**H.E. Saeed Mohammed Al Tayer:** Apart from DEWA, the players with important roles in the programme are our customers, consultants, contractors, and equipment manufacturers.

DEWA's electricity customers play a central role, as they are the prime mover of any project developed under the initiative. DEWA is empowering customers to embark in a sustainability journey that will get them directly involved in the production of clean electricity, it's now their choice to respond to that. Our involvement with customers during the preparation time for the initiatives and in the first months after launch revealed that there is strong engagement and appetite for this opportunity, and this is encouraging. DEWA is already working with a number of customers on projects that are being executed as we speak, and the first solar PV system at a customer's premises, a 30kW array at Al Maktoum Airport, has already been connected to the network.

DEWA is enrolling DRRG Solar PV consultants and contractors to provide customers with the required design, installation and maintenance services for PV systems. Interested customers can reach out to any enrolled company, which will also manage the application process on their behalf. The enrolment scheme is built on an underlying certification scheme for electrical engineering professionals, as DEWA is mindful that only qualified personnel who understands the technical requirements and aware of all safety aspects will be handling grid connected Solar PV systems.

DEWA has already trained at least 70 engineers nominated by consultants and contractors in the two 5-days training sessions held so far, with the third to be held soon. A good number of trained engineers have successfully passed the final test, paving the way for the first consultant's or contractor's enrolment with DEWA. DEWA will offer Training opportunities on a regular basis.

Equipment manufacturers are also important because DEWA is committed to installing equipment that meets the highest standards of safety and quality in Dubai. This is why DEWA developed solar PV equipment standards that have been published on DEWA's website for Manufacturers of solar PV panels, inverters and interface protection can make applications with certificates from accredited international laboratories proving their equipment compliance to DEWA's technical standards. By doing so, manufacturers' equipment will be added to the list of eligible equipment. The creation and publication of such list helps customers, consultants and contractors to easily find the available equipment and inform their procurement process, as they will have easy access to a pool of manufacturers whose equipment can be installed in Dubai under this programme.

DEWA basically provides the platform for the execution of the Shams Dubai initiative. Significant preparatory work has been conducted since the second quarter of 2014 to ensure that the key elements will be in place ahead of the full-fledged launch of the initiative.

This include the setup of the internal capability and processes that allow DEWA to inform customers and applicants to receive, process and approve applications, and to connect PV systems to the distribution grid. We have also upgraded the billing system, so that we can manage the net metering scheme. To ensure public safety, protect the environment and our distribution network, we have published our technical standards and connection guidelines to put in place the technical framework for connected systems.

Other steps we have taken include the launches of an equipment eligibility scheme for specific Solar PV electrical equipment, such as solar PV panels, inverters, and interface protection equipment, and an enrolment scheme for DRRG solar PV consultants and contractors, built on an underlying training and expert certification for engineers and professionals. We have also worked closely with government bodies such as Dubai Municipality and Trakhees on implementing the programme and the project approval and execution.

To ensure that all this information is transparently communicated to everyone involved, we have developed a comprehensive dedicated web section within DEWA's existing website specifically for the Shams Dubai programme. It has been designed to be a simple one-stop shop for customers, consultants, contractors, equipment manufacturers and anyone else interested in learning all the details about solar power and the Shams Dubai initiative. All the information regarding the programme, the connection process, and key documents, are available from a single, well-structured and easy to follow website.



**DEWA has already trained at least 70 engineers nominated by consultants and contractors in the two 5-days training sessions held so far, with the third to be held soon**

## ABOUT H.E. SAEED MOHAMMED AL TAYER



H.E. has an overall experience of more than 31 years in the field of telecommunications, energy and water. Under his leadership since 1992 DEWA achieved unprecedented successes and has become one of the very best distinguished utilities in all aspects worldwide. As an initiative of his own, several successful companies were established, including Emirates Central Cooling Systems Corporation (EMPOWER), and many other companies.

He is a member of Dubai Executive Council and Chairman of Infrastructure and Environment Committee, Vice Chairman of Emirates Global Aluminum (EGA), Vice Chairman of Emirates National Oil Company (ENOC). Also, His Excellency is a member, vice chairman, or chairman of various high-level committees, and higher leading councils in the Emirate of Dubai.

### Q4: What is the link between the Shams Dubai Initiative and DEWA's other smart initiatives?

**H.E. Saeed Mohammed Al Tayer:** Shams Dubai is one of three initiatives being carried out by DEWA to support the wider Smart Dubai initiative of H.H. Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, for Dubai to become the smartest city in the world.

DEWA will connect these panels to the grid and allow any excess power generated to be exported back to its network, encouraging the use of renewable energy and increasing its share in the energy mix. Secondly, smart grids and smart applications will speed up connections and ensure faster responses with immediate reconnections. This will also conserve smart

consumption by using smart meters to improve living standards of all citizens and residents and promote sustainable resources.

The other two, the smart grid and the electric vehicle charging station (EV Green charger) initiatives, also relate with Shams Dubai. Smart grids play a powerful role in providing the supporting infrastructure for the connection of distributed solar power and its effectiveness for a sustainable future. DEWA is implementing its smart grid strategy to create a network that will manage the development of new services and energy technologies, and enhance network management and control, to enable Dubai's

residents to better control their requirements for energy and water. DEWA has started a five-year plan to replace conventional mechanical and electromechanical meters with smart meters to provide customers with detailed information about their electricity and water use, which helps them to better manage their consumption.

Customers who sign up to Shams Dubai and plan to purchase electric vehicles will also benefit from the Green Charger initiative, by being able to use renewable energy to charge their own vehicles, as well as having access to a wider electric vehicle charging structure across the Emirate, with 16 installed and further 84 due to be rolled out within a year.

# PEACEFUL NUCLEAR ENERGY IS CHANGING THE MIX

THE UAE'S NUCLEAR ENERGY PROGRAMME IS POISED TO CUT EMISSIONS, CREATE OPPORTUNITIES AND BUILD A PROSPEROUS AND SECURE FUTURE



ARTICLE

By H.E. Mohamed Al Hammadi



One of the more ambitious clean-energy undertakings in the UAE is the development of the nation's peaceful nuclear-energy programme. Since its beginnings in 2009, the UAE remains on track to deliver four nuclear-energy units under the highest standards of safety and quality. By 2020, Barakah in the Western Region will produce up to one quarter of the UAE's electricity with clean, safe and reliable baseload power.



In its more than 40-year history, the UAE has cultivated a distinctive model to develop the country's energy resources responsibly. Today, as the nation seeks to diversify its energy portfolio and economy, it has applied a thoughtful, engaged process to developing nuclear-energy resources as part of the electricity mix.

After careful analysis, UAE policy-makers decided that energy diversification and energy sustainability would be led by the development of a peaceful nuclear-energy programme and an ambitious renewable-energy initiative. Nuclear energy brought clear advantages to the future of the UAE, including a higher level of energy security and reliability.

By the time all four reactors at Barakah come online, the UAE peaceful nuclear-energy programme will have transformed the nation's energy mix and economy. Throughout its development, the programme's leadership engaged the international community, global energy experts, anti-proliferation advocates and, most importantly, the people of the UAE. Results-oriented management, proactive outreach and a commitment to involving Emiratis forged a level of public confidence that is getting noticed around the world.

In 2012, the UAE produced 101 billion kWh gross, with a 98% reliance on natural gas. As mentioned in the UAE Nuclear Energy Policy, it is expected that the national annual peak demand for electricity will rise to more than 40,000 megawatts by 2020. By many estimates, developing peaceful nuclear power to meet this growing demand will reduce the UAE's greenhouse-gas emissions by nearly 50 million tonnes per year, which is the equivalent of the entire emissions of road transportation in the UAE in 2013 (44.25 million tonnes).

The July 2012 approval of the construction license for the UAE's first two nuclear-energy plants marked the country as the first in more than three decades to inaugurate a new nuclear-energy programme. The UAE model for nuclear-energy development highlights actions that other nations may emulate as they diversify and strengthen their own energy infrastructures.

Formation of the UAE's energy programme began with the government asking a deliberate question: How does a nation establish a peaceful nuclear-energy programme in the most responsible manner? From that question emerged two overarching themes – international cooperation with nuclear-energy experts would ensure the UAE's adoption of industry best practices and complete operational transparency for the people and interested international organisations would build confidence in the UAE programme.



**By 2020, the UAE will move from a 98% reliance on natural gas to an energy mix where up to 25% of electricity comes from clean nuclear energy.**

Development of the UAE's nuclear-energy programme began in December 2009, with the formation of the Emirates Nuclear Energy Corporation (ENEC) and the Federal Authority for Nuclear Regulation (FANR).

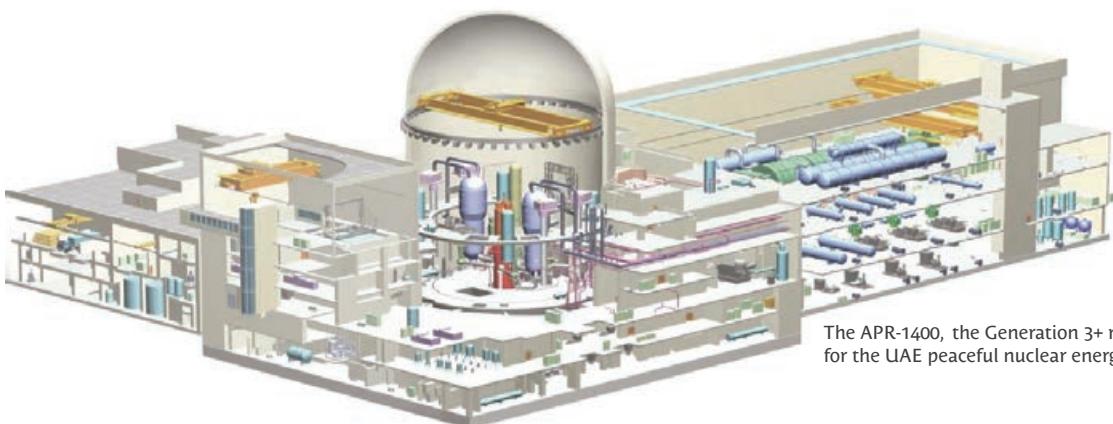
Since the announcement of the project's prime contractor in December 2009, work on the project has been advancing according to the highest standards of safety and quality and in strict adherence to Federal and international regulations.

Currently, construction is progressing in Barakah, some 300 kilometres from Abu Dhabi. The magnitude and complexity of the project has recently established ENEC and Barakah as one of the leading nuclear-energy sites in the world and the only current nuclear project to be constructing four identical nuclear reactors. This is a challenge that ENEC understands and accepts with the responsibility to deliver a peaceful nuclear-energy programme that can safely generate electricity for decades to come and power the future growth of the UAE.

Construction of Barakah Unit 1 is in its final stages and the work is now swiftly moving towards commissioning for operations. The three other units currently under construction will follow at one-year intervals. Each unit will have a gross electric output of 1,400MWe and by 2020, the UAE will have four reactors producing much-needed electricity without emitting carbon dioxide.

From the programme's onset, the UAE decided that nuclear energy would be developed in concert with renewable-energy sources, to make the country an international leader in the deployment and development of emission-free energy technology. In turn, the development of clean-energy technologies and their support industries in the UAE would meet the Federal Vision 2021 of improving the quality of air and preserving water resources through the contribution of clean energy.

Nuclear energy will therefore be a key contributor to the Vision set forward by the UAE leadership and it will have a decisive role in continuing the diversification of the economy and creating additional high-technology opportunities for Emiratis in the private sector. 



The APR-1400, the Generation 3+ reactor selected technology for the UAE peaceful nuclear energy programme.



### ABOUT H.E. MOHAMED AL HAMMADI



H.E. is the Chief Executive Officer of the Emirates Nuclear Energy Corporation (ENEC). Mr. Al Hammadi's management responsibilities include leading the organization towards the safe and efficient deployment of the UAE's first nuclear energy plant as well as ensuring compliance to the commitments of the UAE Roadmap to Nuclear Energy and the regulatory compliance to the Federal Authority for Nuclear Regulation (FANR).

He brings to ENEC a strong background in power and utility projects, including management, construction, finance and administration. Prior to joining ENEC, Mr. Al Hammadi was General Manager of the Federal Electricity and Water Authority (FEWA) where he led a transformational management process focused on the implementation of best practices and international standards to the authority. In this role he made strategic changes in fuel supply arrangements and tariff structures, and negotiated power purchase agreements that enhanced FEWA's ability to deliver value to its commercial and consumer customer base.

The peaceful nuclear-energy programme is opening new doors for leadership through its approach to transparency and international collaboration. ENEC engaged the public proactively to explain the programme and answer questions, and its leadership sustains ongoing efforts to keep the public informed. Teams of experts regularly travel the Emirates to hold public forums and address public interests such as site selection, the safety of the technology and career options within the growing programme.

At the request of the UAE, the International Atomic Energy Agency sent an Integrated Regulatory Review Service (IRRS) mission to help conduct safety assessments. The review panel noted good practices in the UAE system and also made recommendations and suggestions for FANR, the nation's nuclear regulatory authority. "The team was impressed by the speed with which the UAE developed its regulatory framework and established a new regulatory body," said IRRS Team Leader Carl-Magnus Larsson of Australia.

Public involvement in the UAE's energy planning goes far beyond public meetings. The Emirati plan involves the development of sophisticated local teams of engineers and operators to run the nation's nuclear-energy plants and power grid, including a new generation of nuclear engineers, technicians and power specialists who will be at the forefront of the country's post-oil economy. The Energy Pioneers element of the programme has also helped move public attitudes towards a sense of tangible investment in a successful outcome.

The education programmes associated with the UAE's energy policy, while designed with the intent of advancing the nation economically, also spread the word through schools and universities about opportunities that await promising young students interested in peaceful nuclear energy. The message conveyed by ENEC engineers in public meetings and in the classroom reinforces ENEC's broader contributions to Emirati society. The UAE has charted a new path forward built around continued economic diversification and the growth of opportunities for Emiratis through enhanced education initiatives and private-sector employment. The nation's peaceful nuclear-energy programme, steered by ENEC, is an integral part of this.

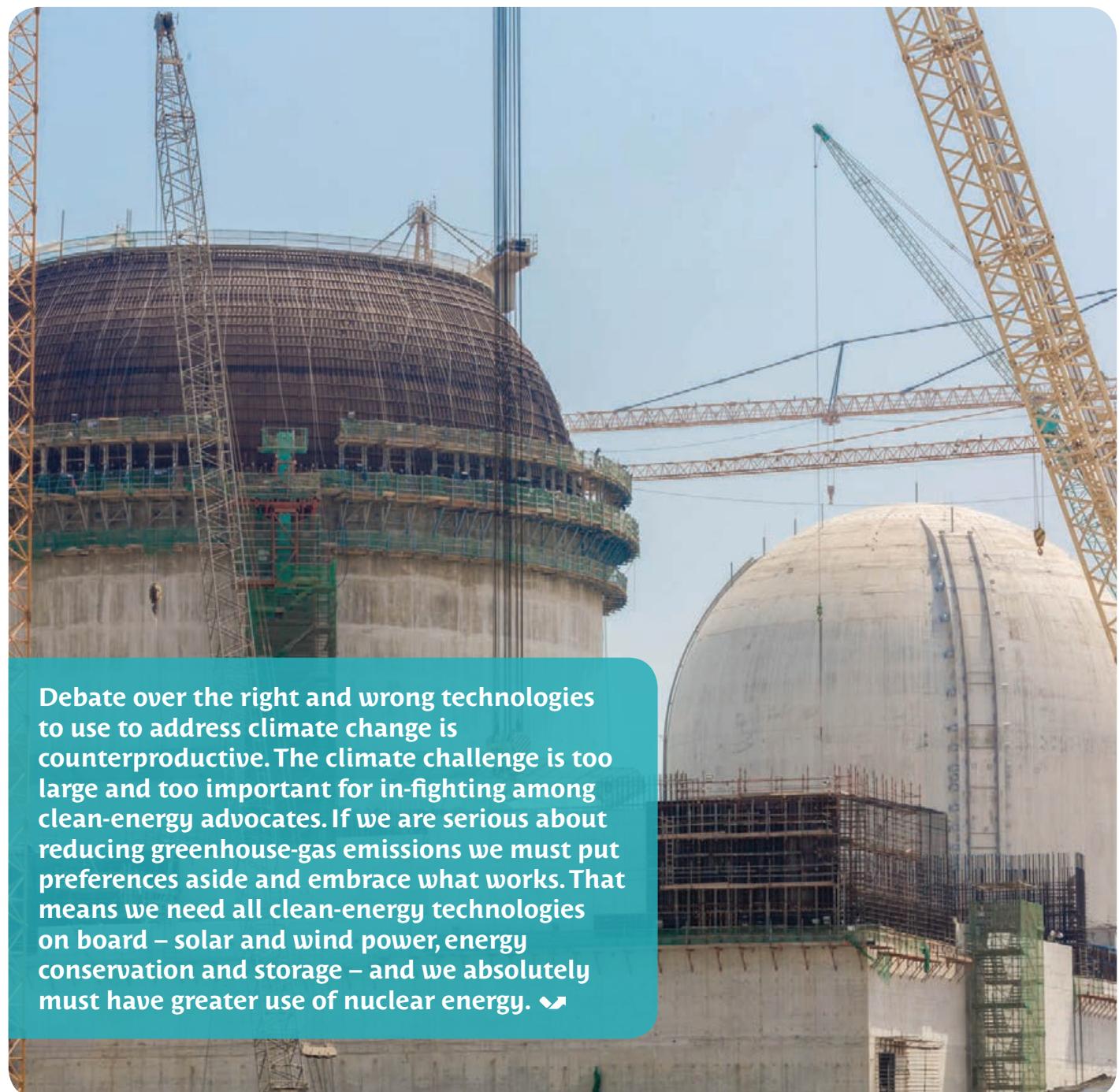
When ENEC connects its first nuclear-energy facility to the grid, it will mark a culmination of efforts to radically reshape the UAE's energy portfolio. The electricity will power new growth for high-tech industries and sustainable economic growth in the UAE. This transformation has been underway for some time and reflects changes taking place elsewhere in the world. In countries where populations are increasing and interest is growing for modern conveniences, the UAE provides a valuable model for the exploration and implementation of nuclear energy as a solution for clean, safe electricity production. The nation's commitment to responsible development of nuclear energy serves as a standard for other nations interested in developing new, peaceful nuclear-energy programmes of their own. ■

# THE NUCLEAR ENERGY CLIMATE IMPERATIVE IN THE UAE



ARTICLE

By  
David Blee



**Debate over the right and wrong technologies to use to address climate change is counterproductive. The climate challenge is too large and too important for in-fighting among clean-energy advocates. If we are serious about reducing greenhouse-gas emissions we must put preferences aside and embrace what works. That means we need all clean-energy technologies on board – solar and wind power, energy conservation and storage – and we absolutely must have greater use of nuclear energy.** ↗



No technology has done more to limit carbon emissions than nuclear energy. It already generates about 11% of the world's electricity. Unlike other clean-energy sources, we don't have to ponder if nuclear energy can be scaled up to meet a nation's electricity needs. We know it can.

Nuclear energy is emissions-free power that isn't held hostage by the whims of the weather or scalability. It reliably produces baseload electricity 24 hours a day, seven days a week. And yet, due to misplaced perceptions regarding its safety, particularly in the aftermath of the Fukushima tsunami, it remains a paradox for some who fully understand the breadth of the climate challenge.

Unfortunately, a small few opposed to nuclear energy have created a misperception about the safety of the technology that does not reflect reality. The facts tell the story. In more than 16,000 commercial reactor-years of operation, in 33 countries, there have only been three significant incidents.

Although nuclear energy is in the midst of a renaissance globally – more than 60 new reactors are under construction in 15 nations – meeting the challenge of rapidly transitioning to a low-carbon future will require deployment of nuclear-energy technology on a far larger scale.

For nuclear energy to fulfil its potential, the world needs leadership not just from long-established commercial nuclear-energy programmes – like those in the United States or France – but from the newcomers who are charting their own course. These next-generation pioneers are pivotally important, both to the climate fight and the future of clean energy, because they are not just setting the standard for new nuclear-energy programmes but they are also pushing aside obstacles so that other nations can potentially follow in their footsteps. In this regard, the UAE is proving a true clean-energy champion and trailblazer.

The UAE's ambition to set the gold standard for the development of a new, peaceful nuclear energy programme is quickly becoming a reality. There are many areas of the UAE's programme worth recognising for excellence. The establishment of an independent regulator and a rigorous commitment to the highest standards of non-proliferation are noteworthy examples, but there are other less obvious achievements that mean just as much to the future of clean energy.

As the UAE has moved from the theoretical development of its programme to actual construction, its ability to work with an international partner and deliver plants safely, on time and on budget is tremendously important. In the same regard, so



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The UAE's nuclear-energy leadership in showing potential nuclear-energy newcomers, how to build a world-class programme

is the UAE's success in developing new, world-class nuclear energy expertise. Progress in both of these areas – often viewed as some of the tallest hurdles to standing up a new commercial programme – provides a workable model for other nations to replicate. In tandem with new-build programmes in the United States and China, the UAE isn't just telling the world how to successfully develop a new nuclear-energy programme: it's showing it.

The climate challenge is uniquely daunting, but it's a challenge we can meet if we commit to making a transition to emission-free energy and embrace all of the tools at our disposal. Clean nuclear energy is critically important to that effort. The UAE's nuclear-energy leadership in showing potential nuclear-energy newcomers, how to build a world-class programme. No one technology, no one nation, can tackle this challenge alone, but a united, all-of-the-above effort can produce smart, carbon-free energy for the 21st Century and the planet.

The United States Nuclear Infrastructure Council is the leading business consortium advocate for new nuclear and the involvement of the American supply chain globally ([www.usnic.org](http://www.usnic.org)). While these views reflect the consensus of the Council, they do not necessarily reflect the views of specific members of the USNIC. ■

#### ABOUT DAVID BLEE



He serves as Chief Executive Officer of the U.S. Nuclear Infrastructure Council – the leading business consortium advocate for new nuclear energy and the involvement of the U.S. supply chain globally.

Mr. Blee was appointed by the Acting Secretary of Commerce to the U.S. Civil Nuclear Trade Advisory Committee in 2013. His public service includes appointments as a Deputy Assistant Secretary of Energy, Director of Public Affairs for the Energy Department and as a Congressional Chief of Staff.

He is a former Executive Vice President for NAC International, where he directed U.S. and international business development as well as the NAC worldwide consulting group.

# RENEWABLE DIPLOMACY

## THE ROLE OF RENEWABLE ENERGY IN THE UAE'S INTERNATIONAL RELATIONS



COMMENTARY

By H.E. Dr.  
Thani Al Zeyoudi



Renewable energy plays a growing role in the UAE, as seen in Emirate and Federal level plans for 2021 and 2030.

Renewable energy also plays another critical role for the UAE internationally, as a channel for energy diplomacy through forums like the International Renewable Energy Agency (IRENA), as a commercial opportunity for the UAE's overseas investments and as a focus area in the UAE's foreign aid programme.

### UAE Energy Diplomacy and the International Renewable Energy Agency (IRENA)

IRENA, headquartered in Abu Dhabi in the UAE, is the only international organisation in our part of the world. Abu Dhabi is for IRENA what New York is to the United Nations (UN), Paris is to the International Energy Agency (IEA) and Vienna is to OPEC and the International Atomic Energy Agency.

Hosting an international organisation is a source of pride for any nation and for the UAE, this is an equally special opportunity: We have supported this young agency since its inception and have played a key part in shaping it.

The UAE first joined the global renewable energy journey in 2006 with the launch of the Masdar Initiative and the subsequent decision in 2008 to bid for hosting IRENA in Masdar City. For a major global player in oil and gas, in a region with no precedent of hosting an international organisation, this was seen by many as a bold move. For the UAE, this was a natural opportunity in line with our role as a global energy leader and our long-term vision for a sustainable future – where renewable energy plays a critical and growing role.

Since then, IRENA has become a unique global hub for renewables with over 170 countries engaged, over 130 employees and countless additions to world leaders' knowledge on renewable energy policy, technology and cost – with the majority of the action happening from its headquarters in the UAE.

Alongside IRENA's emergence, we have seen global developments over these past years. Renewable energy has become mainstream energy, with more gigawatts of new power capacity added through renewables every year than all other technologies combined. We have also seen solar costs falling by more than 80% across the world, where renewables are now outcompeting oil, gas and even coal in some instances.

The UAE's domestic progress on this journey has also been remarkable: Abu Dhabi and Dubai are on track for 7% of renewables by 2020 – compared to nearly zero when our journey started – and are already harvesting the benefits of renewables, such as clean and commercially attractive power as a key part of the pursuit of economic diversification. Dubai's most recent success in competitive solar tendering was headline news. This showcases the UAE's leadership in shifting the regional and global perception of renewable investments.



As the outgoing CEO of SE4All Kandeh Yumkella put it, renewable energy is “not about charity, this is about markets and investment”.

Through becoming the host nation of IRENA and a highly active member country, we are strengthening many highly valued relationships and are building many new ones. Each member country has representatives in the organisation, who, like ambassadors, represent their countries’ interests at IRENA’s two council meetings and the Annual Assembly held in Abu Dhabi. These Regular IRENA meetings present unique opportunities to build and expand dialogue and strengthen commercial ties and energy partnerships. IRENA is an enabling platform for the UAE to reflect and integrate its dedication to forming global alliances and strengthening diplomatic ties in the energy dialogue and efforts.

Through Germany’s representatives to IRENA, for example, we started a UAE-Germany strategic energy dialogue during Abu Dhabi Sustainability Week in January 2015, focused entirely on renewables. Through our French counterparts at IRENA, we have built a strong bilateral engagement process that saw nearly 60 UAE delegates visit French power installations earlier this year. A vital exchange of knowledge and lessons learnt is also in place with the United States through a broader strategic energy dialogue with H.E. the Minister of Energy, ADNOC and many others. Through IRENA and multiple other forums, such as the Clean Energy Ministerial (CEM) initiative of the US or Sustainable Energy for All (SE4ALL) of the UN Secretary-General, we are building and strengthening international relations with partner countries with a focus on renewable energy as a key tool to enable sustainable development.

## The UAE's overseas investments in renewable energy

The UAE has always been a major investor overseas, in assets ranging from major stakes in foreign oil entities to real estate and beyond.

These investments are both commercial and strategic and bring multiple returns, diversifying and strengthening the UAE Economy. Naturally, renewable energy has become a key part of the UAE’s strategic investments being made overseas. A growing list of wind and solar projects across the world are now owned or co-owned by UAE investors, most notably through Masdar, but also through entities like TAQA and others. These include investments in offshore wind in the UK, onshore wind in the United States, Jordan and Oman, solar in Spain and hydro-electricity in India, amongst others. TAQA and Masdar’s overseas renewables portfolio add up to investments in more than 1.5 Gigawatts.

Strategic returns from such projects include strong relationships with international commercial partners and local government as well as the joint development of new knowledge-experience for future project development. The commercial returns are clear – highly attractive assets in the large and growing market of renewables globally.





## Abu Dhabi and Dubai are on track for 7% of renewables by 2020

### The UAE's Renewable Energy Aid programmes

Renewables also play a growing role in the UAE's foreign aid activity. This comes from the recognition that renewables are a clean and cost-effective energy source, vital in economic development, and address the urgent need for financing. Efforts that we started a few years ago are now sizeable and impactful programmes, where effective cooperation between the Ministry of Foreign Affairs (MOFA), the Ministry for International Cooperation and Development (MICAD), the Abu Dhabi Fund for Development (ADFD) and Masdar's Special Projects unit is proving a recipe for success. Twenty-three countries are currently benefitting from the UAE's generous and effective development assistance through RE, with many more to come.

The UAE Pacific Partnership Fund for Renewable Energy, for example, is a real success story. Since its initiation in 2010, the fund has mobilised nearly USD 50 million in

grants for renewable energy projects in 11 countries in the Pacific Region. Ten solar photovoltaic (PV) systems and one wind system have been, or are being, deployed, totalling 6.1MW.

The positive impact of these projects has been significant, with extremely positive feedback from local stakeholders and tangible socio-economic benefits. More than 7,000 homes are now benefitting from access to clean electricity for lighting, air conditioning, water desalination and home appliances, significantly improving livelihoods. Over 10 million clean kilowatt-hours will be provided by solar and wind systems upon project completion, supplying up to 90% of power during peak times on some islands, avoiding over 8,240 tonnes of CO<sub>2</sub> emissions annually. These renewable energy systems are replacing expensive diesel generation, reducing dependency on expensive imported fuels and reducing

carbon emissions. This equates to over USD 3.6 million saved by governments and residents every year.

Another effective vehicle in up-scaling renewables in developing countries is the ADFD-IRENA Project Facility. This is a partnership formed between IRENA and the Abu Dhabi Fund for Development (ADFD), which has committed to provide USD 350 million of soft loans to renewable energy aid projects. Nearly USD 100 million has already been mobilised in 10 countries in Africa, Asia, the Americas and beyond. These loans of up to USD 15 million enable large-scale renewable infrastructure projects as they leverage further financing from other institutions. In January this year, during ADSW, the six latest projects were awarded to solar, wind, hydro and geothermal projects in Argentina, Cuba, Central Asia, Mauritania and St. Vincent and the Grenadines in the Caribbean.

### A new Capital City for Renewables

When looking at renewables for the UAE through an international angle, the 3<sup>rd</sup> of June, 2015 marked a distinctive milestone. His Highness Sheikh Abdulla Bin Zayed al Nahyan inaugurated the new permanent headquarters of IRENA in Masdar City, with the Director General Adnan Amin, International dignitaries and ambassadors, local ministers and guests from across all Emirates celebrating this historic moment – welcoming IRENA home. Renewable energy now has a global capital city right here in the UAE. ■



Since its initiation in 2010, the fund has mobilised nearly USD 50 million in grants for renewable energy projects

ABOUT  
H.E. DR. THANI  
AL ZEYOUNI



H.E. is the UAE Permanent Representative to IRENA and Director of Energy & Climate Change at the Ministry of Foreign Affairs

# THE PLUMMETING COSTS OF RENEWABLE POWER GENERATION

**INSTALLED COSTS FOR WIND AND SOLAR POWER ARE FALLING SIGNIFICANTLY AS DEPLOYMENT GROWS**



ARTICLE

By  
Michael Taylor

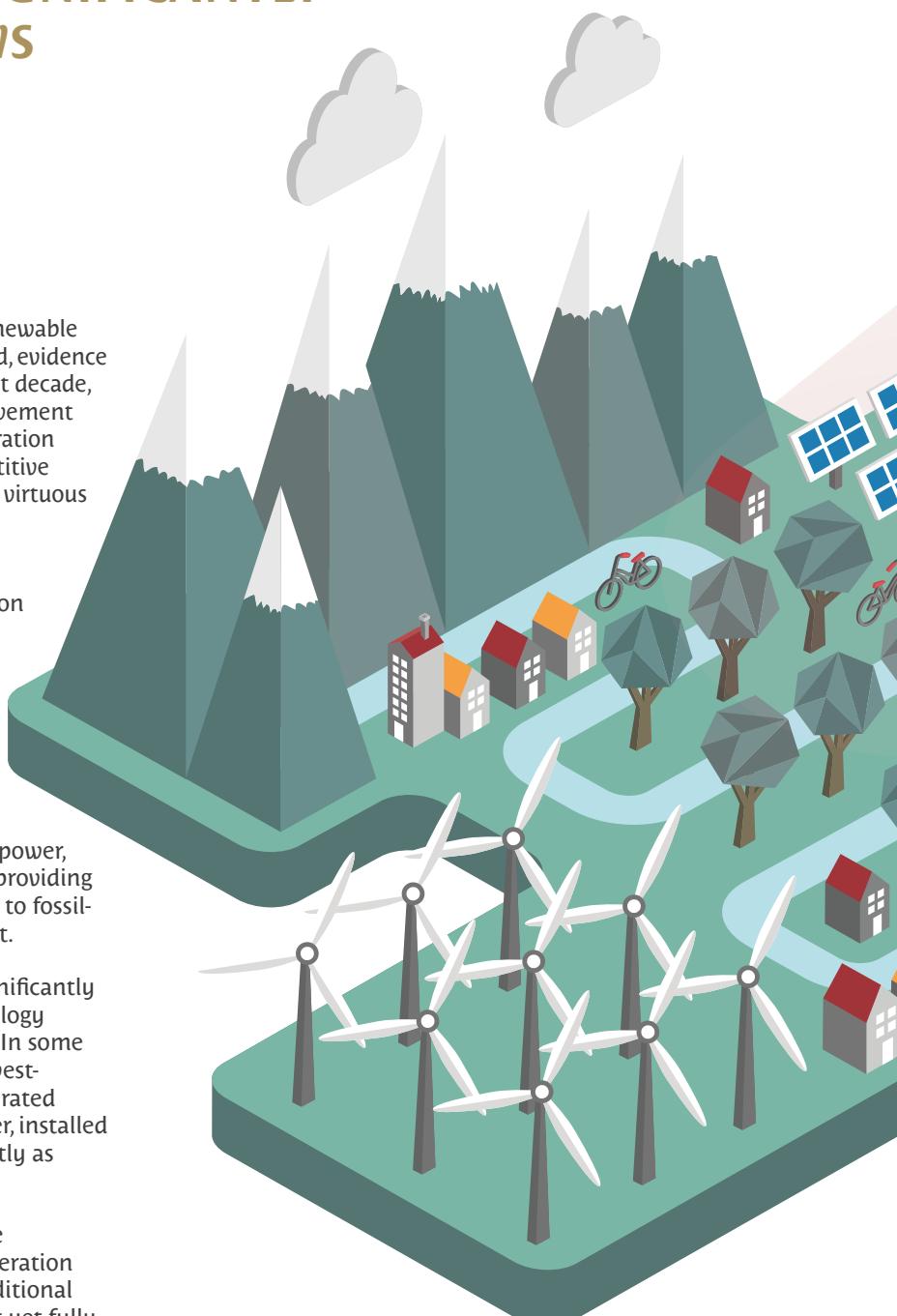
While the environmental benefits of International Renewable Energy Agency are widely acknowledged and accepted, evidence of the economic value has not always been. In the past decade, however, we have seen dramatic and sustained improvement in the cost-competitiveness of renewable power generation technologies. Renewable energy, already more competitive than was widely recognised, is now benefitting from a virtuous cycle of increased deployment, leading to technology improvements and falling costs.

The global deployment of renewable power generation reached a new record in 2014, with the addition of 133GW (6% more than in 2013). Both solar PV and onshore wind had record years for new installations, with the addition of 40GW and 50GW respectively.

This rapid deployment means the cost-competitiveness of renewable power generation technologies has reached historic levels. Biomass for power, hydropower, geothermal and onshore wind are now providing electricity competitively in many markets compared to fossil-fuel-fired power generation, without financial support.

Installed costs for onshore wind power are falling significantly as deployment grows, while improvements in technology mean more wind can be harvested from a given site. In some markets, onshore wind now provides some of the lowest-cost electricity available in the world. With the accelerated deployment of solar PV and concentrated solar power, installed costs for these technologies are also falling significantly as performance improves.

The cost-competitiveness of renewables is even more striking when considering that renewable power generation technologies do not face a level playing field. The additional health and environmental costs of fossil fuels are not yet fully internalised in current pricing structures. IRENA estimates that when accounting for the cost of pollution, including ill health, environmental degradation and CO<sub>2</sub> emissions, doubling the global share of renewable energy would result in savings of up to USD 740 billion per year by 2030.



Renewable power generation technologies are now competing head-to-head with fossil fuels around the world, but this story remains nuanced. The levelised cost of electricity (LCOE) of renewable power generation projects spans a wide range, due to site-specific cost factors (e.g. availability of existing infrastructure, grid connection costs, local labour rates, etc.) and the fact that the quality of the renewable resource varies from one site to another.



The deployment of renewable power generation reached a new record in 2014, with the addition of 133GW

However, what is clear from IRENA's analysis of 15,000 utility-scale projects (9,000 with complete data to calculate LCOEs) and over 740 000 small-scale solar PV systems, is that most renewable energy projects being built today, even with less mature technologies, are now highly competitive in market terms.

What is truly exciting for the Middle East – and indeed throughout the sun-belt – is the rapid cost declines for solar PV, given the world-class solar resources throughout the region. Solar PV module prices in 2014 were roughly 75% lower than their levels at the end of 2009. Between 2010 and 2014, the total installed costs of utility-scale PV systems fell by 29 to 65%, depending on the region. The LCOE of utility-scale solar PV has decreased by half in just four years. The most competitive utility-scale solar PV projects are now regularly delivering electricity for just USD .08 per kilowatt-hour (kWh) without financial support, compared to a range of USD .045 to USD .14/kWh for fossil-fuel power.

The Middle East, with its strong civil-engineering sector and access, in many cases, to low-cost financing is witnessing the beginning of a new era of power generation. The recent tender of the Dubai Electricity and Water Authority demonstrates this shift. With a tender price for 200MW of under USD .06/kWh, this project comfortably undercuts alternatives. In a similar vein, Jordan's recent tender results have also locked in power prices of between USD .061 and USD .077/kWh for 200MW of capacity.

With growing populations and abundant solar resources, meeting energy demand growth with solar PV will now increasingly be the economic option. For oil-producing nations in the Middle East that use substantial energy for power generation, adding solar PV is increasingly the quickest, least risky way to add export capacity and revenue while at the same time satisfying rapid demand growth for electricity. The economic benefits are as obvious as they are immense.

The Gulf has traditionally not had significant deployment of renewables, but the meeting of excellent solar resources, falling solar PV costs, local civil engineering and financing expertise is about to change that. The future of renewables in the Gulf is looking brighter by the minute. It really is the dawn of a new era.

For more on IRENA's latest costing report visit:  
<http://irenaneWSroom.org/2015/01/17/renewable-power-costs-plummet-many-sources-now-cheaper-than-fossil-fuels-worldwide/>

## ABOUT MICHAEL TAYLOR



He is a senior energy analyst at IRENA with 20 years' experience in energy modeling, the economic analysis of energy-sector issues and energy-policy development. Michael is responsible for IRENA's analysis of renewable technologies cost and performance, which started with power generation and transport and will soon cover stationary applications.



INTERVIEW:  
**ROBERTO  
DE DIEGO  
AROZAMENA**

**CEO, Abdul Latif Jameel  
Energy and Environmental Services**

**Outlook on the UAE and the Gulf's  
burgeoning renewable energy market**

## SOLAR'S GOT THE POWER

**Abdul Latif Jameel has been leading the way in areas ranging from property development to transportation and consumer goods to infrastructure, for nearly 70 years from the heart of Arabia through the fast-developing Middle East, North Africa, and Turkey (MENAT) region. Roberto De Diego Arozamena, CEO of Abdul Latif Jameel Energy and Environmental Services, evaluates the renewable energy sector in the UAE and Gulf region.**



**On a regional level, we are also very optimistic that the implementation of similar renewable energy targets in Saudi Arabia, Egypt, Kuwait, Oman, and Bahrain**

### Q1: What is your view on the renewable energy sector in the UAE and how does it compare to its peers in the GCC?

**Roberto de Diego Arozamena:** I'm encouraged to see the UAE has taken a leading role in the adoption of renewable energy over the last couple of years, led by the Government's plans to move away from oil and gas as its primary sources of power generation. The stated intent is to have 24% of the UAE's total electricity output generated from clean energy, including solar, wind and nuclear power, by 2030.

The move towards renewable energy is clear in other GCC countries as well, with serious energy-efficiency measures taken by GCC governments to meet the increasing demand for electricity, which itself is driven by rapid economic and population growth in the region.

We see significant strides taken towards delivering the strategy of the Supreme Council of Energy in Dubai to diversify the energy mix and reduce consumption by 30% by 2030. The UAE, represented by DEWA, has been ranked first in the Middle East and North Africa and fourth globally, for the second consecutive year, in getting electricity with a 90% fuel-consumption efficiency rate, (according to the World Bank's Doing Business Report). Masdar has also been an outstanding role model for the world, thanks to the holistic view it has taken in its work to favourably position the perception of renewable energy and sustainability around the world.

Another encouraging factor is the significant fall in renewable energy costs in recent years. Prices of photovoltaic panels have dropped by around 60% since 2011. A prime example is DEWA's Phase Two of the Mohammed bin Rashid Al Maktoum Solar Park in Dubai, one of the biggest Independent Power Producer (IPP) projects in the global renewable energy market, which has now commenced work to increase its capacity by 200MW. Grid parity has already been achieved in Dubai. The bid for this project was the lowest worldwide, beating out the current cost of power generated from natural gas. We believe that this could lead to a boom in solar energy in the region, particularly in relation to Saudi Arabia and that country's latent potential.

So the outlook in the UAE is very bright, and is backed by the Government's solid plans to create environmentally friendly sources of energy. The priority on the National agenda is to create a sustainable economy that is balanced socially, economically and ecologically. We are seeing strong evidence towards the achievement of this goal.

On a regional level, we are also optimistic that the implementation of similar renewable energy targets in Saudi Arabia, Egypt, Kuwait, Oman, and Bahrain will provide a boost to the burgeoning renewable energy sector in the Middle East – a region with tremendous untapped renewable energy potential.

### Q2: Why the focus on renewable energy when the price of hydrocarbons has fallen so dramatically making renewables less commercially attractive?

**Roberto de Diego Arozamena:** Globally, renewable energy has become a serious part of the energy mix, with the share of renewable energy set to more than double in the next 20 years to provide one quarter of global energy needs by 2050. Our view is that renewable forms of energy will continue to grow robustly and remain financially competitive as technological developments and increased innovation reduce costs even further.

Only a fraction of total hydrocarbons is used for electricity generation. Therefore, on a global basis, the reduction of oil prices is only marginally affecting generation costs. In any case, if we use world retail fuel prices to calculate the costs of generating electricity with hydrocarbons, we will find that solar energy is being produced at less than half the cost of diesel power generation. On average, retail diesel prices drive a generation cost in excess of USD .15/Kwh, which is more than double the most competitive solar prices.

If we consider the MENAT region (Middle East, North Africa and Turkey), population growth, ambitious government policies being driven by energy security concerns and the exponential growth in demand for energy are all contributing factors driving the need for more investments in alternative means of energy generation.



The share of renewable energy is set to more than double in the next 20 years to provide one quarter of global energy needs by 2050

### Q3: What are the biggest challenges, as well as opportunities facing the renewable energy sector, and solar Photovoltaic (PV) manufacturers in the region?

**Roberto de Diego Arozamena:** The opportunities for solar PV in the region, where solar radiation is at its highest in the world, are tremendous. The significant drop of 75% in cost associated with generating electricity from solar power in the last seven years is expected to boost global solar photovoltaic installations by more than 25% (Bloomberg New Energy Finance and EPIA Global Market Outlook 2013-2017). For energy-producing countries in the GCC, the adoption of solar PV translates to lower consumption of oil and natural gas for power generation, freeing up resources for export, and ultimately fuelling economic diversification and growth.

The GCC, while benefitting from the highest levels of solar irradiation in the world, has a harsh environment. Many institutions are investing in research and development programmes in order to improve the performance of renewable energies in high temperature and high dust environments.

Another challenge faced by renewable energy is its intermittent nature. Solar produces when it is daylight and wind turbines only when it is windy. The answer is to complement solar and wind with storage solutions. Some renewables like concentrated solar power (CSP) already offer the opportunity of thermal storage, however, we believe that with so much R&D focusing on battery storage, the cost of storing electricity will continue to fall, eventually allowing photovoltaic and wind-generation facilities to support a stable supply to the grid by using electrical storage technology.

### Q4: What is the growth strategy for Abdul Latif Jameel Energy and Environmental Services?

**Roberto de Diego Arozamena:** Our desire is to become a leading renewable energy supplier and an independent power producer (IPP). Our focus is on building local capacity and establishing a lasting legacy of energy-sector expertise by taking a leading role in diversifying national energy production in strategic markets across the world. Our recent acquisition of Fotowatio Renewable Ventures (FRV) is tangible evidence of the steps taken towards the achievement of our goal.

By leveraging the comprehensive platform and in-house capabilities we have now established, we aim to strengthen our market position by aggressively pursuing opportunities and bidding for additional business. We will address more renewable energy solutions and develop local-delivery capabilities. In doing so we will strive to create jobs for young nationals while develop training and technology transfer programmes to leave a legacy of renewable energy expertise where we establish projects.

## Q5: What is the rationale behind acquiring FRV?

**Roberto de Diego Arozamena:** FRV has brought us a great team with 10 years of solar plant development experience of multiple gigawatt scale. This now positions us as one of the leading solar developers in the world.



The UAE, represented by DEWA, has been ranked first in MENA and fourth globally (...) in getting electricity with a 90% fuel consumption efficiency rate



## Q6: Where do you see the most potential for renewables in the region?

**Roberto de Diego Arozamena:** We see great potential generally in the wider MENAT region and with this in mind we have made Dubai the centre of gravity for the Abdul Latif Jameel Energy and Environmental Services business. Saudi Arabia continues to present a strong opportunity as well as other countries, namely Egypt, Jordan and Morocco. We also have a significant pipeline of projects in other parts of the world. This gives us the opportunity to bring best practice and performance experience to our core markets. ■

### ABOUT ROBERTO DE DIEGO AROZAMENA



He is the CEO of Abdul Latif Jameel Energy and Environmental Services, where he is responsible for driving the growth of Abdul Latif Jameel's global energy business and leading its strategy to strengthen its position as an international independent power producer in the renewable energy sector with a focus on the Middle East, North Africa and Turkey (MENAT) region.

# A NEW HUB FOR SOLAR POWER RESEARCH AND DEMONSTRATION IN THE UAE

## THE MASDAR SOLAR HUB ACCELERATES CLEAN AND RENEWABLE ENERGY INNOVATION



By Dr.  
Steve Griffiths



Solar energy is rapidly becoming an economically viable source of power generation globally and regionally. In fact, solar power is now the fastest growing power-generation technology globally due to rapidly falling costs and increased awareness of the negative impacts of fossil power generation on climate, health and energy security. IRENA's REMAP 2030 study for the UAE has shown that solar power can economically provide more than 25% of the country's power by 2030. Although this is more ambitious than current UAE solar targets, Dubai has upwardly revised its 2030 solar-power deployment target to 15% of installed power-production capacity by 2030 and Abu Dhabi has announced an increase in scale from 100MW to 350MW for its planned solar photovoltaic project.



**IRENA's REMAP  
2030 study for the  
UAE has shown  
that solar power  
can economically  
provide more than  
25% of the country's  
power by 2030**

In order to accelerate adoption of solar power in the UAE and the region, effective solutions must be developed for operating challenges, which for solar photovoltaic (PV) technologies are high temperatures, intense ultraviolet light exposure, high humidity and dusty conditions. Concentrating solar-power (CSP) technologies face many of the same operating challenges as PV and in addition, require advancements in high-temperature operation and thermal-energy storage to achieve cost competitiveness with fossil power generation and solar PV. Achieving the required operational and technological improvements for both PV and CSP requires a focused and coordinated effort in research, development and demonstration. This is the aim of the Masdar Solar Hub, an integrated facility launched in 2015 to provide state-of-the-art facilities to address regional challenges in PV and solar-thermal technologies.

The Solar Hub, which is jointly managed by Masdar and the Masdar Institute of Science and Technology, is located in Masdar City, Abu Dhabi. It consists of a photovoltaic test facility, concentrating photovoltaic (CPV) test facility, 10MW PV power plant and CSP technology development and testing facility. In close alignment

with the UAE National Innovation Strategy, the hub is intended to accelerate clean and renewable energy research and innovation by bringing together industry, government and academic stakeholders in the exchange of technological know-how that supports manpower development, accelerated technology deployment and the formation of new startup companies.

The CSP technology development and testing facility, known as the Masdar Institute Solar Platform (MISP), provides the infrastructure for solar-thermal technology research, development and demonstration. The platform is built around a set of unique facilities at Masdar City, including a beam down concentrating tower consisting of 33 heliostats and a 20-metre high central reflector tower that has 45 central reflectors to beam down reflected light to a ground receiver and produce a peak of 130kW of thermal energy. A hot oil loop at the facility allows oil to be used as a heat-transfer fluid up to a maximum operating temperature of 393°C for thermal energy storage (TES) work. The facility is designed to accommodate multiple simultaneous thermal-energy storage (TES) research and development projects that are aimed at reducing the cost of TES systems, increasing the working temperature of TES systems to more than 1,000°C and developing novel sustainable TES materials and integrated solutions. Projects currently being conducted at the facility by Masdar Institute include development and testing of a direct absorption molten salt receiver and storage system in collaboration with the Massachusetts Institute of Technology (USA) and testing of a high-temperature concrete thermal energy storage system in collaboration with NEST AS (Norway).

Current TES research at Masdar Institute that will ultimately be demonstrated at the MISP includes the development of TES materials from locally sourced desert sand as well as recycled steel and aluminum waste. Beyond TES, CSP component technologies being studied at the facility include new, lightweight silicon carbide (SiC) coated mirrors that are being assessed in collaboration with IBIDEN Co. Ltd. (Japan) for cleanliness and durability in the UAE's humid desert conditions.

The solar hub's photovoltaic test facility is poised to play a key role in enhancing regional PV deployment. The facility is being developed with partners ABB and TUV Rheinland and will provide independent and accurate measurement of performance, reliability and durability of PV modules, coatings of PV modules and other PV-related equipment. Studies conducted at the facility will include quantification and analysis of PV module degradation and energy yield and also support the development of maintenance and cleaning strategies for PV modules. Results from analyses performed will validate PV technology performance under the UAE's harsh environmental conditions and serve as a validation for similar performance under environmental conditions regionally.

The CPV Test Facility will support testing of CPV systems under Abu Dhabi's challenging environmental conditions. Testing of CPV systems at the facility will allow an understanding of the effects of dust, ambient temperature and haze on energy output. Data obtained from this facility will be relevant for the design of future CPV technology as well as the deployment of CPV technology in the region.

Despite solar power's increasing cost competitiveness and efficiency, challenges remain that must be addressed if solar energy is to play a major role in regional electricity systems. The Masdar Solar Hub provides the platform for Masdar Institute, Masdar and leading organisations in the solar industry to overcome these challenges and accelerate the deployment of solar power in the UAE and the region. ■

ABOUT  
**DR. STEVE GRIFFITHS**



He is Vice President for Research and Associate Provost at the Masdar Institute of Science and Technology. He leads the Institute's research activities, which include energy, water and environment, microsystems and sustainable engineering systems.

# Developing a Sustainable Legacy



**Abdul Latif Jameel Energy and Environmental Services is a pioneering force in the global renewable energy sector.**

The largest GCC-based developer of photovoltaic solar energy solutions today – we are driving technological advancements to lead the region in creating sustainable energy legacy.

With our energy partners, we are determined to lead the UAE and the region's move to sustainable energy – meeting these growing needs through infrastructure development, sustainable power generation, alternative resources, and energy efficiency.

Part of one of the region's most respected businesses; we draw on over 70 years of expertise, across 31 markets, to deliver as your trusted partner in building a sustainable future.

Discover more at [alj.com/energy](http://alj.com/energy)

**Abdul Latif Jameel**  
ENERGY



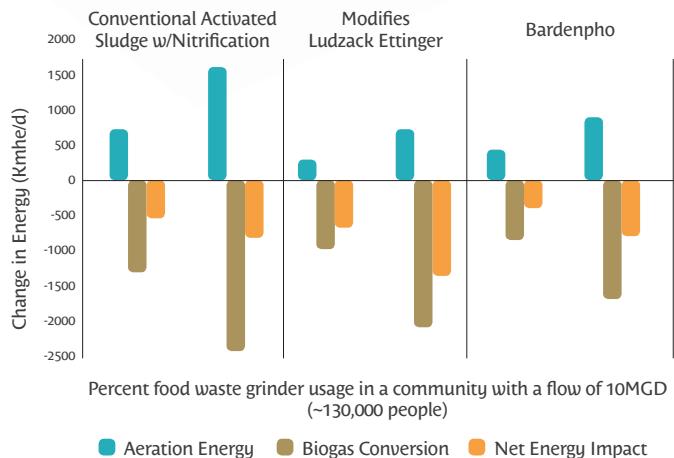
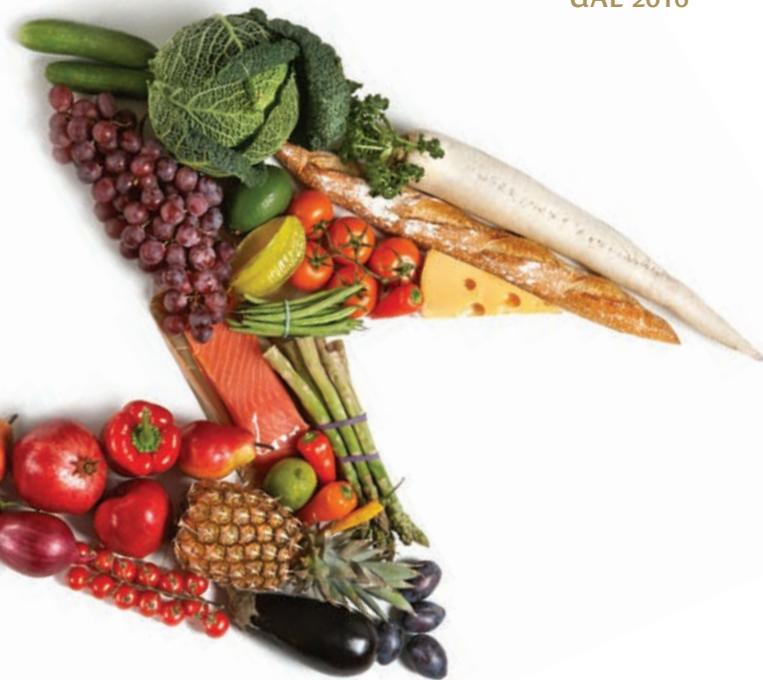
# THE LOST ENERGY IN FOOD WASTE



ARTICLE

By  
**Mohamed Karam**

Developing or finding safe, secure, and reliable sources of energy to power world economic growth are among the great challenges of our time. Creating energy from food waste is no longer just a dream, but it does bring up many questions such as, is it practical? How will it affect our existing systems? How many KW could be generated from one kilogramme of food waste and how does it get put to use?



The Water Environment Research Foundation (WERF) answered some of those questions in its 2012 study, Sustainable Food Waste Evaluation, which examined cost-effective, sustainable alternatives to landfills for the management of food waste. Formed in 1989, WERF is the leading independent scientific research organisation dedicated to wastewater and storm water issues and has a portfolio of more than USD 134 million in research. According to their study, using a food-waste disposer with underground sewers and a modern wastewater facility utilising anaerobic digestion is the least costly option for food-waste disposal, with a modest carbon footprint.

How much power can be derived from converting food waste to energy? The question cannot be answered with a simple explanation or a single number. That's because every treatment plant uses slightly different processes. One cannot calculate the net energy impact of using disposers without making assumptions, dependent on how the food waste is processed. Some facilities use a process known as anaerobic digestion, where methane gas generated from the breakdown of organic waste is used in engines to produce heat and power, also known as cogeneration. Other systems use aerobic digestion – and both of those use a wide variety of other schemes too numerous to list here, all impacting energy-use and output.

Two researchers at InSinkErator modelled the use of disposers on three types of wastewater treatment plants to quantify the energy produced. Their work arrived at the conclusion that if food waste was added directly to digesters, the amount of energy generated is 280kWhe/MT. Sending food waste through disposers and sewers results in slightly different impacts for each plant modelled in the study.

The researchers modelled three types of plants treating 10 million gallons per day and estimated the net energy produced for situations in which varying degrees of the population owned disposers. The chart to the right shows the amount of energy produced for two of the scenarios for each type of plant. ■

ABOUT  
**MOHAMED KARAM**



He is the Senior Business Development Manager for the Middle East and Africa (MEA) at Emerson. He has over 19 years of experience working as an expert and proficient brand-builder across key industry verticals. His exposure to various international market segments has allowed him to be more aware of various cultures – an advantage in communicating more effectively with stakeholders, partners and consumers. As Business Development Manager, he has been responsible for driving in more business for the company, especially in Middle East and African markets.

# DUSTING OFF THE UAE SOLAR POTENTIAL

**ADVANCES IN CLEANING TECHNOLOGY ARE COUNTERACTING THE UAE'S SOLAR POWER CHALLENGE: DUST**



The performance of solar-energy systems is influenced by the ability of the mirror to reflect solar radiation to the collector surface



UNITED ARAB EMIRATES  
MINISTRY OF ENERGY



By Eng.  
Bilal Hassan



**Solar power has over-achieved given its short lifetime in the UAE. The UAE government has taken consolidated action towards increased utilisation of indigenous solar-energy resources to improve energy security and diversify the economy. This is bearing fruit and the business viability of solar technologies has improved beyond all expectations and forecasts. However, available solar technologies, whether Concentrated Solar Power (CSP) or Solar Photovoltaic (PV) are not native to the desert environment and face local climatic challenges, in particular, those related to dust accumulation or soiling.**



The dust issue is still clouded in mystery. Project developers have been barraged with numerous technologies, often lacking an established track record through short and long-term testing by local or regional testing laboratories. State-of-the-art solar testing laboratories have sprouted up across the GCC region, including King Abdullah University of Science and Technology, The Kuwait Institute of Scientific Research, Masdar Institute and The Qatar Environment and Energy Research Institute. It is crucial for such laboratories to cooperate, rather than work as silos, and be strong market players that are actively involved in public-sector decision-making as well as technology procurement. The laboratories should provide advisory support to guide relevant stakeholders on soiling and its mitigation.

The performance of solar-energy systems is influenced by the ability of the mirror to reflect solar radiation to the collector surface (in CSP) or the cover glass to transmit solar radiation to the underlying semi-conductor layer (in PV). Dust accumulation or soiling is a major problem in dry, arid locations, where usually a good solar resource is available. In particular, CSP is more sensitive to soiling than PV due to its different optical properties. In CSP, dirt does not only impact the mirrors, but also the absorber tubes. Cleanliness of the modules has a linear impact on the performance of CSP plants.

So do we really have a dust issue? Yes. The rate of soiling is much higher in the GCC region compared to some other desert environments. In Saudi Arabia, it was recorded as a 14% increase per month compared to 1% per month in Arizona over similar timeframes. In the GCC region, the dust issue is further complicated by salt and moisture, which enhances the buildup of layers of cemented particles on the panels. These layers result in substantial solar-power generation losses.

The Performance Ratio (PR) is defined as the ratio of actual array output energy to the theoretical energy available. In Qatar, the PR decreased at a rate of 0.3% to 0.5% per day due to dust accumulation on PV modules with a cumulative degradation of 10-15% per month. This represents substantial power losses and clearly an efficient, low-water technique for dealing with soiling is vitally important to the solar market in the UAE and the GCC region.

So what defines this troubling dust? Dust is generally considered to be all particles below 500µm; where a human hair is about 50µm. Many atmospheric particles such as pollen, mineral particles, vehicle-emission particulates, sand lifted by winds, and so on, are small enough to be characterised as dust. Soiling can be measured as either the rate at which such particles accumulate on the module surface or the resulting decrease in power production. The rate of accumulation of particles is often measured as the reduction of surface reflectance compared to its clean state and ranges between 0 and 100%. A fully clean surface has 100% reflectance, a figure which is reduced with increasing levels of dust accumulation. Several hand measurement devices are available in the market for measurement of specular reflectivity and hence, soiling. These soiling measurements, even within a single plant, often deviate due to localised factors such as proximity to roads (asphalted or compressed sand); the height of panels from the ground; surrounding sand dunes; wind directions; cleaning cycles; and so on.

Ideally, from a cost and efficiency perspective, regular rain is useful in clearing accumulated dust. However, with on average 4 to 5 rainy days per year, Mother Nature cannot be banked upon in the UAE. This leaves two main approaches for managing soiling: preemptive and restorative. 

Preemptive approaches aim to avoid dust accumulation. Soil-resistant surfaces can considerably reduce the accumulation of dust on the solar module. Many concepts are incorporated in the development of soil-resistant surfaces. For instance, hard surfaces are less susceptible to embedding particles or being damaged by them; smooth surfaces are less likely to trap particles; and hydrophobic surfaces are less attractive to ionic species – the absorption of solids as well as retention of water. Manufacturers are continuously trying to employ such concepts in the development of solar modules that are resistant to dust accumulation. Such developments need to be complemented by outdoor testing in the UAE by local testing laboratories. The economic impact of such advancements in terms of maintenance cost-savings need to be enumerated and shared with sector stakeholders.

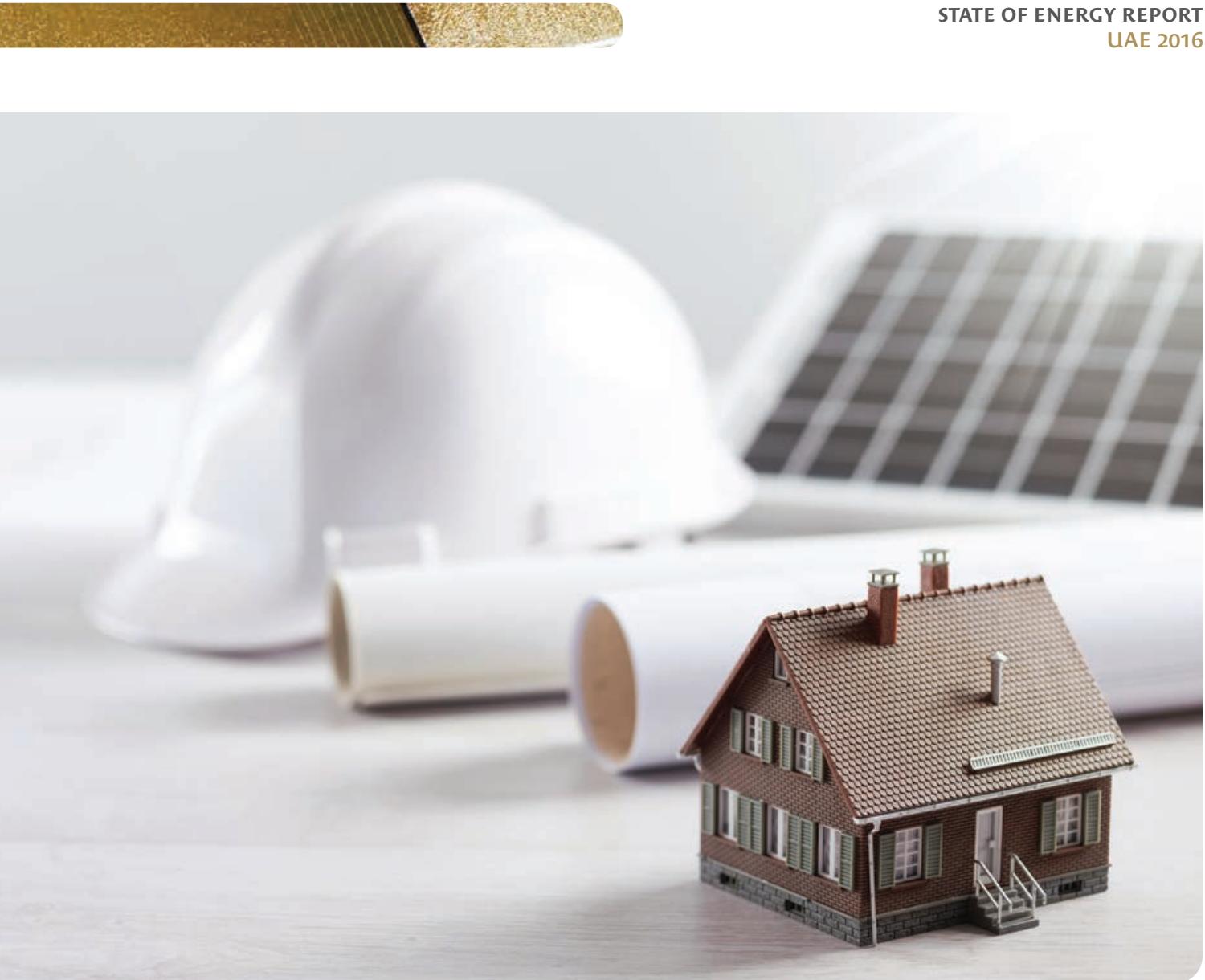
Some additional methods include siting, module protection, terrain preparation and cultivation of foliage or plants. Siting in accordance with prevailing trends for weather, soil surveys and aerosol mapping is very important but is often not part of the decision-making process due to the lack of available data and information. The Research Center for Renewable Energy Mapping and Assessment (ReCREMA) at Masdar Institute has performed significant research in dust or aerosol mapping to a high degree of accuracy. However, it is crucial that the results are utilised in effective decision-making. Many other techniques are also incorporated for handling dust in the UAE. For instance, the Shams 1 project in Abu Dhabi has a wall constructed alongside its entire plant boundary to prevent the inflow of sand from the surrounding dunes.

On the other hand, restorative approaches aim to clean the solar modules once sufficient dust has accumulated. Cleaning the modules is one of the most important considerations for solar-plant operation and maintenance due to the high concentration of aerosols as well as inflowing sand particles in the UAE. The cleaning methods can be segregated into two types: manual and motorised. Even manual broom or mop cleaning has been optimised through innovative cleaning mechanisms. In comparison to single-handed broom cleaning, customised, dual-handed, cleaning brushes were developed for the DEWA 13MW project to optimise the cleaning man-hours. This cleaning method is waterless, simple and robust and targets desert utilities with low labour costs.

In comparison, motorised methods include travelling brushes along one dimension, two dimension or multi directions (robots). The brushes able to travel along one dimension are simple, robust and easy to retrofit, however, such systems are only viable for limited row widths in large ground-mounted plants. The brushes usually require additional rails and periodic battery replacement. An example is the NOMAD battery-powered dry brush developed at King Abdullah University of Science and Technology, Saudi Arabia, which requires twin-mounted rails with a maximum row width of 4 metres. The technology is costly as one device is required for each row. The viability of such systems is improved for longer row lengths. In comparison to one-dimensional brushes, two-dimensional brushes allow wider rows, however, such brushes have complicated designs; are harder to retrofit; have a short track record; and are often customised for each plant. The robots provide increased flexibility (no guiderails or other retrofit requirements); are light and portable; and are easy to try and implement. However, the robots have complex moving parts, are relatively slow and have limited capacity and a short track record.

The availability of water is one of the primary concerns for solar project developers in the UAE and the GCC. In this respect, durable superhydrophobic coatings offer promising technologies that can make PV panel cleaning much easier and more cost effective. More importantly, such coatings enable the use of both freshwater and saltwater as cleaning agents, with no requirement for detergents. Such technologies still have a limited track record and require further investigation.

The GCC Regional Solar Testing Facilities Network seeks to link the region's leading solar-testing facilities to collaboratively work on key issues such as soiling, which hamper the development of the sector. Within the framework of the network, a scientific workshop on anti-dust technologies for solar systems was held in Doha from 21-23 January 2015. Its goal was to provide the region's solar researchers, project developers and end users with an in-depth understanding of current and emerging technologies for reducing soiling. The workshop was attended by network representatives from Saudi Arabia, Qatar, Kuwait, Dubai, and Abu Dhabi. The workshop aimed to answer two key questions: which of these technologies are most promising for the GCC environment and are they ready for commercial use? The Ministry of Energy of UAE supports this endeavour and hopes this discussion evolves further to present viable solutions in the near future. Furthermore, the Clean Energy and Climate Change department at the Ministry is exploring collaborative, mutually beneficial partnerships between local, regional and international institutions to seek solutions to the soiling issue, among other concerns, for the combined benefit of the UAE and the region. ■



**ABOUT  
ENG. BILAL HASSAN**



He graduated with a Masters in Mechanical Engineering from Masdar Institute and worked initially in the International Renewable Energy Agency (IRENA) as a Strategy and Research Analyst for the Country Support and Partnerships Unit. He recently joined the Ministry of Energy of UAE as a Clean Energy Expert and has initiated various projects in areas such as distributed solar; renewable energy mapping; national energy balance; federal energy strategy; and carbon capture and storage.

“

**In Qatar, the [Performance Ratio] decreased at the rate of 0.3% to 0.5% per day due to dust accumulation on PV modules**



# ENERGY & TRANSPORTATION

## HIS EXCELLENCY MATTAR AL TAYER

CHAIRMAN OF THE BOARD AND EXECUTIVE DIRECTOR,  
ROADS & TRANSPORT AUTHORITY



The RTA's journey towards energy management started a number of years ago when it added environmental sustainability as a key element in its Strategic Plan for 2008. This journey has continued over the years since then, so today, we have the RTA Integrated Energy and Green Economy Plan that sets the RTA's direction towards the goal of a green economy and energy conservation.

The RTA has carried out 32 energy-conservation and eight green-economy support initiatives. These

initiatives are expected to achieve savings of around AED 17 million. This will be achieved through covering various RTA sectors and agencies, so contributing to saving power consumption in Dubai Metro stations and the railway. Additionally, they will help to reduce water consumption, improve road lighting efficiency by using energy-efficient LED lighting, cut down on bus diesel consumption, and slash taxi fuel expenditure, as well as reduce carbon dioxide emissions in 2013 by 41%, as compared to 2012.

# ENERGY-EFFICIENT TRANSPORTATION

HOW DEVELOPING  
A MODERN, RELIABLE TRANSPORT  
NETWORK CONTINUES TO BE  
A PRIORITY FOR THE UAE



ARTICLE

By H.E.  
Faris Saif Al Mazrouei



Currently, one of the country's most anticipated infrastructure projects is the new federal railway being constructed and operated by Etihad Rail. Stage One, the 264-kilometre-long route is already completed and trains are currently running on a daily basis with trains of up to 110 wagons hauled by three massive locomotives. The total fleet comprises seven locomotives and 240 hopper wagons and operates around the clock to transport as much as seven million tonnes of granulated sulphur from two plants in Shah and Habshan in the Western region of Abu Dhabi to the sulphur-handling terminal at Ruwais Port. As part of Stage One of the project, Etihad Rail recently celebrated the milestone of having transported two million tonnes of sulphur for export.



The continued plans to upgrade the public transport infrastructure across the UAE, highlights a growing trend and appetite for such services

The project will have significant positive economic and environmental effects. One benefit will be reduced reliance on road vehicle transport and a drop in greenhouse emissions.

Etihad Rail has procured state-of-the-art and highly-efficient, diesel-electric locomotives to service its network. The decision was made partly to ensure ease of interoperability with the rail networks of neighbouring countries currently under development. Etihad Rail has also planned an upgrade strategy into its design to electrify all or part of the network if the business case can be made.

On average, the company has calculated that one full train of 11,000 tonnes of sulphur can remove approximately 300 trucks from the road, thus reducing congestion and improving safety. A fully loaded train produces up to 80% fewer carbon emissions compared to lorries loaded with the same tonnage.

When the network is fully completed, it will be approximately 1,200 kilometres in length. A total of AED 40 billion is expected to be spent on the core national network which will remove an estimated 24 billion tonne kilometres off the road network and generate AED 100 billion in economic benefits over a 30-year period.

Besides bulk freight of granulated sulphur, the trains will eventually also be transporting products such as aggregates, steel, cement and containers for general freight. Etihad Rail has already signed memorandums of understanding (MoUs) with major players such as Khalifa Port in Abu Dhabi, and Jebel Ali Port in Dubai. To date, over 40 companies, including manufacturers, quarries and logistics providers have signed MoUs expressing their interest to use rail as a preferred method of transport for goods and materials.

Work is also progressing on Stage Two of the project, where the rest of the Abu Dhabi railway network is developed alongside a connection with Dubai. Stage Two will connect vital industrial areas such as Ruwais, Khalifa Port in Abu Dhabi, as well as Jebel Ali Port in Dubai.

Close cooperation has also been established with railway authorities in other gulf countries such as Saudi Arabia, Oman and Qatar. Etihad Rail will not only connect the Emirates, but also form an essential part of a wider GCC railway.



### Plans in the UAE

The UAE is also continuing with the upgrading of public transport infrastructure within cities. In Abu Dhabi, the Surface Transport Master Plan is making provisions for extensive infrastructure upgrades to benefit members of the public and businesses alike by increasing mobility and reducing traffic congestion and environmental pollution.

In Dubai, a tram system serving the areas of Jumeirah Beach Residence, Dubai Marina and Al Sufouh was launched late last year. Use of the public transport system, which currently includes buses, two metro lines, the tram line and marine transport, has been increasing steadily. In the first half of 2015, an estimated 271 million trips were recorded – an increase of 8.7 million trips compared to the same period last year.

The Dubai Roads and Transport Authority has since announced it will be building 12 new marine stations to serve the Business Bay Canal and Dubai Water Canal. Marine transport in the Emirate currently attracts an estimated 13 million users per year.

In addition, a property developer has commissioned the building of a hydrogen and electric-powered trolley tram to serve the Downtown Dubai area. Phase one of the project will cover three stations, followed in the future by more stations currently at the planning stage.

The availability of more public transport options is slowly reducing dependence on private vehicles – the most widely-preferred option in the country. Another factor, which is expected to influence the public's behaviour, is the recent decision to deregulate the prices of gasoline. Until the changes came into effect in August, transport fuel prices in the UAE were among the lowest in the world, although they were still much higher than those in neighbouring countries.

Continued plans to upgrade public transport infrastructure across the UAE highlights a growing trend and appetite for such services. Saving energy is always at the top of the agenda for any transport service and as a result we will start to see hydrogen and electric-powered services start to filter into the UAE's transport networks.

Overall, the rise in fuel prices should encourage more people to opt for more efficient vehicles and public transport solutions, whenever these options are convenient. ■



A total of AED 40 billion is expected to be spent on the core national network which will remove an estimated 24 billion tonne kilometres off the road network and generate an AED 100 billion in economic benefits over a 30-year period

#### ABOUT H.E. FARIS SAIF AL MAZROUEI



As CEO of Etihad Rail, he is responsible for leading construction projects and operations. Faris joined Etihad Rail in 2010. He successfully led the project's development during this stage, including the launch of railway testing and commissioning of the Habshan-Ruwais section in September 2013. He was appointed CEO in 2014.





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الأنماء العربية  
**Arab Development**



# THE UAE'S VEHICLE EMISSIONS STUDY

ENOC HAS ANALYSED THE LOCAL FLEET AND COMPARED VEHICLE EMISSIONS WITH INTERNATIONAL BENCHMARKS



By Dr.Eng.Waddah S.Ghanem Al Hashimi  
& Eng. P.Radhakrishnan





The US limits in units of mg of pollutant emitted per km travelled are 2,125 for CO, 250 for NOx and 156 for HC

In keeping with its commitment to environmental protection and the sustainable use of resources, ENOC conducts regular research and shares the results with concerned parties. Some of the studies, such as Environmental Impact Assessments (EIA) and Environmental Site Assessments (ESA), are intended for internal stakeholders. However, other studies, one of which is the subject of this article, are designed to assist external stakeholders such as regulatory bodies and government agencies in their sustainable-development pursuits.

Earlier studies for external stakeholders included a study on exhaust emissions from vehicles for DIA/Dnata in 2005 and a study on vehicle emissions in Dubai and Sharjah in 2008. The focus of these studies was pollutant emissions from vehicles and recommendations on steps to be taken to reduce emissions. The latest study is much broader in scope and relates to fuel efficiency, carbon and pollutant emissions from petrol vehicles in Dubai. The research work started in 2013 and the final report was completed in 2015 and reviewed by Dubai Carbon.

The study was limited to petrol vehicles as they are the largest contributors to pollution within the category of road transport in Dubai. The emissions of concern from petrol vehicles are carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), nitrogen oxide (NOx), hydrocarbons (HCs) and particulate matter (PM). CO<sub>2</sub> emissions are responsible for global warming and directly reflect the fuel efficiency of the vehicle. The other emissions are called criteria pollutants and have adverse effects on human health, as well as significant environmental impact such as acid rain and photochemical smog<sup>1</sup>.

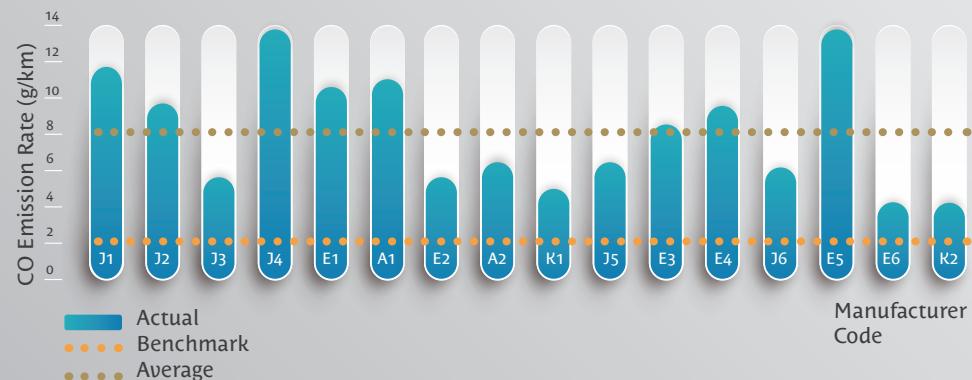
Emissions data was gathered from published sources such as the World Bank, UN and the EU and US Environmental Protection Agency (USEPA). The data consisted of three main categories: per capita emissions for various countries, vehicle emission standards and fuel efficiency. The UAE was the second-largest per capita emitter of CO<sub>2</sub> with more than twice that of UK emissions in 2010. Per capita NOx emissions in the UAE were also high, about twice that of US and over four times that of European countries. In saying this, due to the size of the UAE population, the per capita emission ratio should be used with caution.

The UAE standards for vehicle emissions are limited to CO and HC concentrations, which are required to be less than 4.5% and 800ppm respectively. Both the EU and the US have fleet-specific emission requirements for CO, NOx and HC and additionally CO<sub>2</sub> and PM for the EU. These specifications mean that the average emissions from all vehicles sold by a vehicle manufacturer should not exceed the specified limits. If the manufacturer sells highly polluting vehicles they must compensate by selling a large enough number of low-emission vehicles. The US limits are more lenient than the EU, hence these were taken as the benchmark for comparing results. The US limits are in units of mg of pollutant emitted per kilometre travelled and are 2,125 for CO, 250 for NOx and 156 for HC. As the US did not have any limits for CO<sub>2</sub> at the time of this study, the EU limit of 140g/km was used.

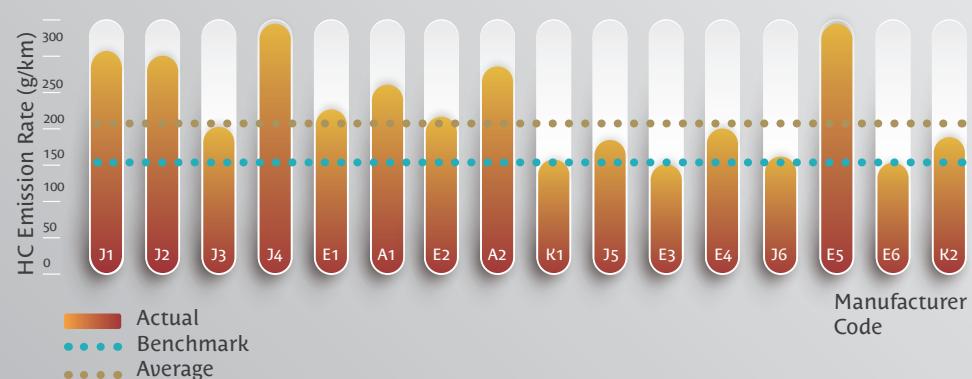


The UAE standards for vehicle emissions are limited to CO and HC concentrations, which are required to be less than 4.5% and 800ppm respectively

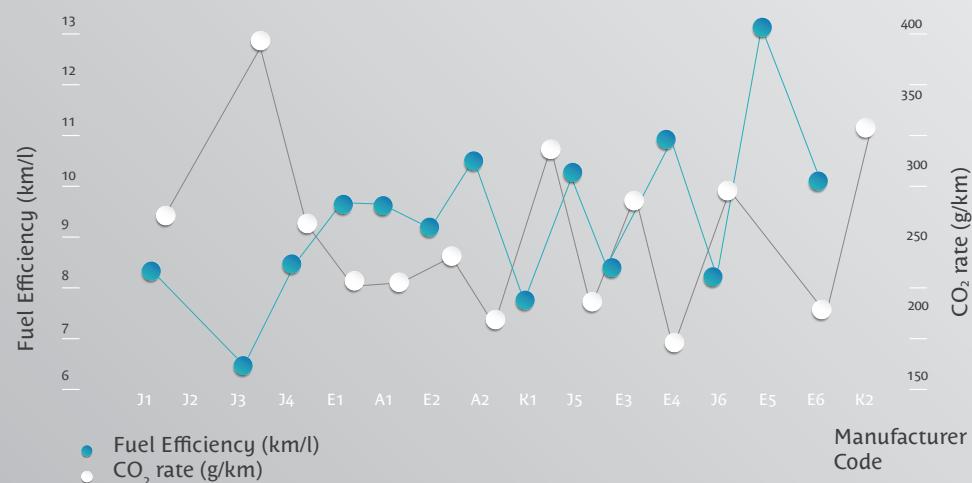
### CO Emission Rate per Manufacturer



### HC Emission Rate per Manufacturer



### Fuel Efficiency (km/l) and CO<sub>2</sub> Rate(g/km) per manufacturer



Following the published data review, field data was collected. The field data spanned 14 months from December 2011 to January 2013 and was obtained from vehicle testing stations in Dubai. The parameters of importance for this study were CO, HC, manufacturer and model of vehicle and kilometre reading. CO<sub>2</sub>, NOx and PM values would have been useful but are not measured, as the emission standards of Dubai do not require this measurement. Quality assurance methods were carried out on the raw data and data that contained errors or was incomplete was removed. The remaining good data was used for further analysis.

The first step was to determine the distance covered, fuel consumed and amount of CO<sub>2</sub> emitted by each vehicle. This was carried out by using the published combined fuel-efficiency data for the model from the manufacturer or the USEPA. Once completed, the total kilometres and CO<sub>2</sub> emission rate for each manufacturer were obtained and compared to the benchmark of 140g/km. None of the manufacturers met the benchmark figure. The best was 180g/km and the worst 360g/km, a range of 30% to 160% above the benchmark. The average was 80% above the benchmark, indicating a fuel efficiency of about half that of the EU. This was no surprise as the proportion of large vehicles is high in the UAE.

Next, the CO and HC emission rates were calculated using the measures of CO and HC concentration from testing and the calculated CO<sub>2</sub> rate above. None of the manufacturers met the lenient CO benchmark of 2,125mg/km. The average CO emission rate was about 8,000mg/km, around four times the benchmark and eight times the EU limit of 1,000mg/km. The HC emission rate was more promising with more than half of the manufacturers meeting the US rate of 250mg/km, though not the EU limit of 60. All Korean and almost all European manufacturers were under the limit, however, the average emission rate for HC was 30% above the benchmark. It may be noted that all of the above vehicles passed the Dubai emission test requirements.

In conclusion, with low fuel prices and the absence of incentives for fuel-efficient vehicles, the high emission rates of CO<sub>2</sub>, CO and HC are understandable and will continue unless changes are made to the way vehicles are tested and priced. Without change, manufacturers have more incentives to sell larger, less fuel-efficient vehicles due to higher margins.

To reduce pollution from vehicles and conserve fuel, the following recommendations are made.

**1** Firstly, test requirements for vehicle emissions should be enhanced to include NOx and PM tests. The UAE may consider a fuel-efficiency labelling system for vehicles on the same lines as those that exist for electricity-consuming equipment

**2** Additionally incentives and disincentives for efficiency, or lack of it, may be considered through variable registration fees, parking charges and toll charges. ■



**1** Photochemical smog is a condition that develops when primary pollutants (oxides of nitrogen and volatile organic compounds created from fossil fuel combustion) interact under the influence of sunlight to produce a mixture of hundreds of different hazardous chemicals known as secondary pollutants.



## IT'S A FACT

Petrol vehicles emit carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), nitrogen oxide (NOx), hydrocarbons (HC) and particulate matter (PM). CO<sub>2</sub> emissions are responsible for global warming and directly reflect the fuel efficiency of the vehicle. The other emissions are called criteria pollutants and have adverse effects on human health, as well as significant environmental impact such as acid rain and photochemical smog.

### ABOUT DR.ENG.WADDAH S.GHANEM AL HASHIMI



He is the Executive Director – EHSS & Corporate Affairs at ENOC. He has a Bachelor's Degree in environmental engineering, an MSc in Environmental Science from UAE University and an Executive MBA and later a DBA from Bradford School of Management, UK. He has co-authored three books on organisational management and holds senior roles in numerous Corporate Affairs and EHSS and organisational committees.

### ABOUT ENG. P.RADHAKRISHNAN



He is Chief EHS Compliance Officer (Environment & Energy) at ENOC. He has a BTech and MS degree in Chemical Engineering. He has over 30 years' experience spanning areas such as research and development, operations, QHSE and energy in manufacturing, chemical, petroleum and power industries.



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# THE ROAD AHEAD: TOWARDS A UAE VEHICLE FUEL ECONOMY REGULATION

WHAT STEPS IS THE UAE  
TAKING ON VEHICLE  
FUEL ECONOMY?



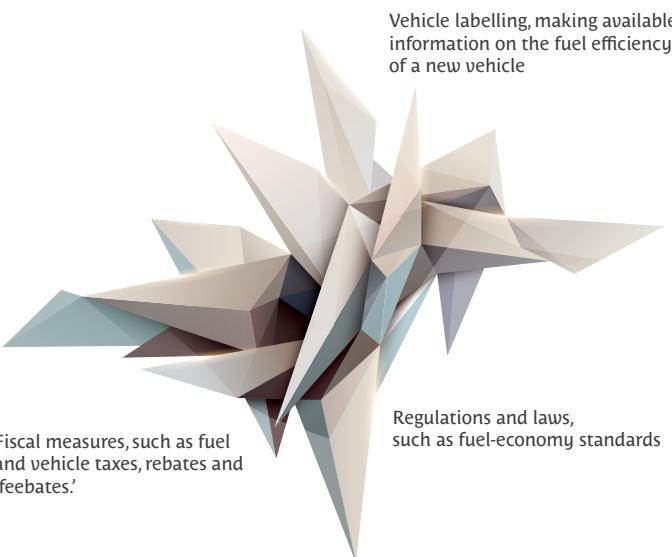
By Dr. Deepti  
Mahajan Mittal

A growing desire for mobility is concomitant with development. Urban sprawl has led to a rapidly increasing use of road transport, with the global fleet of cars expected to triple by 2050.<sup>1</sup> The United Arab Emirates (UAE) is a prime example of a fast-growing automobile market where sales of light-duty vehicles (LDVs, including passenger cars and light trucks) grew by 76% between 2010 and 2013.<sup>2</sup> Globally, the transport sector uses more than half of the oil consumed and within the sector, three quarters of the energy used is consumed by road travel.<sup>3</sup> The scale of fleet expansion – viewed in conjunction with road transport's contribution to energy use, greenhouse-gas emissions and air pollution – underscores the need for sustainable road transport to be a policy priority. The adoption of vehicle fuel economy policies the world over, including in the countries of the Gulf Cooperation Council (GCC), points to a recognition of this critical area of intervention. This feature seeks to outline the UAE's plans to develop a vehicle fuel economy<sup>4</sup> regulation geared towards reducing carbon emissions from the transport sector and realising attendant energy and economic benefits.

## Why a vehicle fuel economy regulation for the UAE?

Fuel economy improvements reduce fuel consumption and CO<sub>2</sub> emissions. Globally, fuel economy could yield a 50% decrease in fuel use per kilometre for new cars by 2030 and save an estimated USD 2 trillion by 2025.<sup>5</sup> According to one estimate, the EU, US and China could reduce their aggregate annual CO<sub>2</sub> emissions by more than 1 gigatonne in 2030 through a combination of stringent vehicle performance standards and high fuel fees.<sup>6</sup> In consonance with the trend, UAE's growing LDV market provides potential for reductions in gasoline consumption and associated CO<sub>2</sub> emissions. It is estimated that improving the efficiency of vehicles in the UAE could yield the equivalent of 10 million tonnes CO<sub>2</sub> of carbon savings up to 2030.<sup>7</sup> The savings would increase over time as the proportion of new, more efficient vehicles increases in the fleet.<sup>8</sup>

In order to move vehicles towards the higher end of the fuel-economy spectrum, a basket of policy measures is needed:



The development of mandatory regulations or standards has been proven to be the most effective way of increasing fuel efficiency in nine implementing countries/regions.<sup>9</sup> In the European Union (EU), the annual CO<sub>2</sub> reduction rate for new cars increased from about 1% prior to 2008 to about 4%, following the introduction of mandatory CO<sub>2</sub> standards; the 2015 fuel economy target was met two years in advance.<sup>10</sup> A trend of increasing efficiency has also been seen in the US where an increased stringency in standards beginning 2007, led to larger fuel-economy improvements.<sup>11</sup>

In support of ESMA's vehicle fuel-economy regulation development process, a study is being undertaken under the aegis of the UAE Ecological Footprint Initiative, a partnership between the Ministry of Environment and Water, Environment Agency – Abu Dhabi, Emirates Authority for Standardisation and Metrology (ESMA), Global Footprint Network and Emirates Wildlife Society – WWF (EWS-WWF). The Steering Committee of the initiative includes, amongst others, representatives from the Ministry of Energy, Federal Transport Authority – Land and Maritime, Roads and Transport Authority – Dubai and Department of Transport – Abu Dhabi. With support from EWS-WWF, ESMA is leading the policy process and engaging with relevant government and private stakeholders. 

Table 1 shows the initial fleet analysis which suggests that the UAE LDV fuel-economy average is close to KSA and US averages. The EU market is significantly more advanced.

### Table 1. Comparison of New Light-Duty Vehicle Fuel Economy

Vehicle Type	UAE	KSA	US	EU
Passenger Cars	14.8	15.4	15.0	19.7
Light Trucks	10.0	10.0	10.5	16.4
All Light Vehicles	12.1	12.0	13.0	19.4

Fuel Economy in km/l on CAFE test cycle



**Source:** Research undertaken by The International Council on Clean Transportation, 2015

### Fuel economy developments in the GCC

Aimed at making fuel economy a parameter in purchase decisions, labelling is the first step towards an effective fuel-economy policy framework. Recently, the GCC Standardization Organization (GSO) adopted a standard ‘Update for No. 42’ on ‘General Requirements – Motor Vehicles’ that made fuel economy labelling mandatory (from the date of effect) for LDVs being sold in the GCC countries. The GSO has also introduced a labelling requirement for tyre rolling resistance – a fuel economy accelerator since low rolling resistance contributes to fuel efficiency.

However, in order to improve average fuel economy, a regulation that sets mandatory targets for vehicle manufacturers to supply more fuel-efficient cars, will need to be in place. The Kingdom of Saudi Arabia (KSA) has adopted a mandatory regulation which will come into effect in January 2016 [Saudi Arabia Fuel Economy Standard for Incoming Light Duty Vehicles (2016-2020), [http://www.saso.gov.sa/en/standards/Pages/Standard\\_fuel\\_economy.aspx](http://www.saso.gov.sa/en/standards/Pages/Standard_fuel_economy.aspx)]. The KSA requirements are modelled on the US Corporate Average Fuel Economy (CAFE), building in a four-year lag through 2018 and a three-year lag thereafter up to 2020 (for example, KSA 2016 requirements for manufacturers are the same as US 2012 and KSA 2020 the same as US 2017). The KSA CAFE standard requires that each automobile manufacturer has a mandated fuel-economy value for its passenger car fleet and its light truck fleet. This fuel-economy value is a sales-weighted harmonic average of all vehicles’ actual fuel-economy values under that vehicle class. Thus, the standard gives vehicle manufacturers the flexibility to supply the market with more efficient technologies by improving its sales mix, without limiting consumer choice.

The study also seeks to examine the potential technical (fuel savings), economic (costs and benefits for consumers and the government, and payback time) and environmental (reduction in carbon emissions) implications that may result from the application of a standard in the UAE. It will define possible market surveillance procedures and examine other policy instruments that can complement mandatory standards. These instruments could include fiscal incentives to buy fuel-efficient vehicles, fuel-economy consumer education programmes, and vehicle tyre rolling resistance improvement programmes.

The label requirements approved at the level of the GSO will equip consumers to make informed choices. With a conducive global and regional policy environment, the time is right for the UAE to develop a locally relevant fuel-economy regulation that mandates fuel-economy targets for manufacturers. This will ensure that the country receives advanced and efficient vehicle technologies and partakes in the advantages that accrue from them – reduced fuel use and emissions and attendant economic and public health benefits. For the UAE, reduced domestic oil consumption will also translate into increased availability of oil for export. Well-designed fuel-economy policy packages can help leverage the significant opportunities for such co-benefits.<sup>12</sup>



#### FOOTNOTES

- 1| International Energy Agency (IEA), Transport, Energy and CO<sub>2</sub>, 2009, <https://www.iea.org/publications/freepublications/publication/transport2009.pdf>.
- 2| Research undertaken by The International Council on Clean Transportation (ICCT), 2015.
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## ABOUT DR. DEEPTI MAHAJAN MITTAL



She is Project Manager, Ecological Footprint Initiative, at Emirates Wildlife Society in association with WWF. Here she is leading research and engagement activities in development of sustainable energy policies. She was earlier with The Energy and Resources Institute, India, and has wide experience in energy and climate projects, having worked with clients including UN-ESCAP, IUCN and DFID, amongst others.

# RTA'S CONTRIBUTION TO A SMART DUBAI

**MOBILE APPLICATION  
BRINGS THE AUTHORITY  
AND ITS SERVICES CLOSER  
TO ITS CUSTOMERS**



By  
**Abdulla Al Madani**

The Government of Dubai, launched the Smart Government Initiative to turn Dubai into the smartest city in the world and determined two years for the completion of this leading project. The deadline expired on 22 May, 2015 and more than a month before that deadline, RTA announced the completion of converting all services offered to customers to smart services that are innovative and easy to use. RTA converted 173 services covering three main categories: road users, public transport users and the business sector. These services are offered through 10 smart applications.

This unique accomplishment was achieved due to the care and guidance of the UAE leadership under the UAE leadership.

While converting its services to be smart, RTA placed at the top of its priorities that its applications would be innovative, creative and easy to use to achieve happiness for the users of the smart applications. It re-engineered and designed three services to be smart. RTA engaged students from five universities and several companies in the design of smart services and their testing.

In order to maintain excellence in the provision of smart services, RTA put at the forefront of its priorities a focus on the ongoing improvement and development of these smart services. It also enhanced the spirit of innovation among young people, particularly university and college students. In January 2015, RTA launched a contest for university and college students to develop smart applications. The winners of the contest will be announced during GITEX 2015. RTA also developed a partnership with private sector and strategic partners to provide quality smart services to clients.





smart applications contributed to increasing efficiency and generating savings in excess of AED 200 million



The spiralling use of smart applications in the public transport and taxi sectors of RTA has stepped up the integration of mass-transit systems in Dubai. It has contributed to increasing efficiency and generating savings in excess of AED 200 million, increased bus compliance with timetables and brought added happiness to customers. In 2014, bus compliance with on-time exiting of depots was as high as 99%, Dubai taxicabs covered about two billion kilometres, and the average time of dispatching a taxicab to customers was 13 minutes and 43 seconds.

From an environmental perspective, RTA's smart apps contributed to the achievement of environmental sustainability, the conservation of energy sources for future generations and realisation of the strategic goals of the Dubai Government. These strategic goals aim at improving the level of services and making people happier.

Once the Smart Dubai initiative was announced, RTA charted out a roadmap for the transition to a smart city. This plan encompasses the launch of at least 200 smart services via smartphones by the end of 2015 and 22 further initiatives in support of Dubai's migration to a smart city. While embarking on the transition to smart services, RTA attached attention to ensuring innovation and accessibility features in its smart apps in order to bring more happiness to users. RTA completed the reengineering and redesign of 36 services, which have been transformed into smart services. It also engaged about 80 students from five universities, as well as several companies, in designing and testing the smart services.◆



This plan encompasses the launch of at least 200 smart services via smartphones by the end of 2015

We, as a work team in the RTA, are keen on mapping out an important philosophy in designing services, so that they become both accessible and easy-to-use, particularly as we provide more than 200 services over smartphones. Our focal attention and methodology revolves around customers and keen to use a variety of communication channels in order to identify prime service needs and embark on providing them over mobile phones. We will also engage directly during the design and testing phases of the apps to be developed. We will be developing a galaxy of creative services in a variety of fields related to vehicle parking, vehicle licensing and public-transport means.

In the near future, the RTA will be focusing on sustained improvements and development of smart services and enhancing the creative spirit amongst youth, especially university students. The RTA will also uplift the partnership with private sector and strategic partners to deliver excellent smart services to clients.

RTA has pledged to be the leading government entity in delivering its smart apps to the public across all social segments, taking into account that the services provided must be seamless, easy and fast. We are continuing to work towards the vision of H.H. Sheikh Mohammed bin Rashid Al Maktoum, UAE Vice-president, Prime Minister and Ruler of Dubai, in bringing happiness to people including UAE citizens, visitors, businesspeople and tourists from all over the world, and strive as a team to make Dubai the world's best smart city in road and transport systems. ■



### ABOUT ABDULLA AL MADANI



He is the Chief Executive Officer of the Corporate Technical Support Services Sector at Roads and Transport Authority. His agency is in charge of providing effective support for all RTA agencies and sectors to ensure an adequate working environment through the utilisation of state-of-the-art technology, which involves reducing operational costs, augmenting work efficiency, planning and implementing information technology systems. Abdulla has intensive practical experience over more than 15 years in senior management and is currently responsible for running five critical support departments, serving six of RTA's sectors/agencies.

# GREEN CHARGER INITIATIVE

## ELECTRIC VEHICLE CHARGING STATIONS

In October 2013, H.H. Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, launched the Smart Dubai initiative to transform Dubai into the smartest city with the implementation of 100 initiatives and 1,000 smart services that enhance living standards in the Emirate and support its sustainable development.

Dubai Electricity and Water Authority (DEWA) has launched three strategic ground-breaking initiatives to support Smart Dubai. These include Shams Dubai, to generate solar energy in buildings and connect them to DEWA's grid, installing smart meters and networks, and establishing the infrastructure to build electric vehicle charging stations, called the Green Charger.

These initiatives will effectively contribute to the UAE Vision 2021, and the Dubai Plan 2021 to transform Dubai into an integrated smart city that sustainably manages its resources and environment. The Smart initiatives will also help create a smarter and better future for all residents in the Emirate of Dubai.

In February 2015, DEWA inaugurated the first electric vehicle charging station in Dubai, at its headquarters. This pioneering initiative will greatly support DEWA's efforts to reduce the carbon footprint, protect the environment, and drive Dubai's sustainable development forward.

The first phase of the project include the installation of 16 charging stations for public use. Each station can accommodate two vehicles at the same time. Twelve stations have been installed at DEWA's centres, which can charge 24 vehicles simultaneously. These stations are at DEWA's headquarters, the Sustainable Building in Al Quoz, Al Wasl, Al Hudaiba, Burj Nahar, Umm Ramool, and Jebel Ali. These stations have been installed and are ready for use for customers who can set up a payment account, with costs fixed at AED 0.29 per kilowatt hour. In March 2015, another station was installed in Dubai Silicon Oasis and two more are due to be installed in Dubai Design District (D3).

Dubai Silicon Oasis, TECOM, Dubai Holding and ENOC have signed MoUs with DEWA to support its three initiatives, which mandates the installation of photovoltaic solar panels, the development of efficient and sustainable smart applications, and the establishment of infrastructure and charging stations for electric vehicles in all the projects developed by these organisations.

During the second phase of the project, 84 charging stations will be installed across Dubai. These include fast, public, and home charging stations. They will be installed at Dubai Airports, Dubai Municipality, RTA and other locations such as shopping malls, petrol stations, hotels, and parking areas. The project is scheduled to be completed by the end of 2015. ■

DEWA will build three types of electric vehicle charging stations that are compatible with the latest international technologies used in electric vehicles. These include: Fast charging stations that take 30 minutes and will be available in petrol stations. The other two types are charging stations that take 4 hours and 6-8 hours, respectively. The choice of the type of charging station will be based on recommendations by the project's consultants.

In June 2015, DEWA registered the first green charger user led by a growing interest from customers in Dubai and in other Emirates for charging their electrical vehicles.

DEWA plans to set up 100 charging stations across Dubai by 2016 as part of its efforts to encourage people to buy or rent zero-emission electric cars.

DEWA is committed to delivering the necessary infrastructure for electric vehicles to facilitate and accelerate the process of its deployment in local markets, in addition to maintaining a clean and sustainable environment, reducing Dubai's carbon footprint and promoting Dubai's position as a global hub for environmental sustainability. ■



ARTICLE

By  
**Eng. Waleed Salman**

### ABOUT **ENG. WALEED SALMAN**



He is EVP Strategy and Business Development at Dubai Electricity and Water Authority. He is also in charge of Corporate Strategy and Business Development and oversees new business ventures in areas such as product diversification (e.g. Mai Dubai), energy efficiency (e.g. Etihad Energy) and low carbon development (e.g. Dubai Carbon). He is a leading figure in the Emirate's quest for green economic development through his involvement as a member of Dubai Supreme Council of Energy, the World Green Economy Summit, the Green Economy Partnership as well as internationally in the 'De-carbonise Energy' Global Agenda Council of the World Economic Forum.



# SUSTAINABLE DEVELOPMENT AND ELECTRIC BUSES



FACT BOX

By  
Abdulla Yousef Al Ali

**This is an era where human practices are having negative impacts on nature and resources, which is reflected in greater concentrations of greenhouse gases in the atmosphere, coupled with an imbalance of the global climatic system. It has therefore become imperative to take remedial action towards curbing the carbon footprint and conserving Mother Nature for future generations.**

Here in Dubai, the Roads and Transport Authority (RTA) has shown determination to meet the challenge looming on the horizon by embracing the environmental initiative of the Government of Dubai, under the theme "Green Economy for Sustainable Development". The initiative comprises six key drivers, namely: green energy, government policies, green city, coping with the impacts of climate change, green life and green technology. The overall objective of the initiative is to transform Dubai into a model in reducing the carbon footprint. In this sense, RTA responded by launching the Green Economy Award in 2013 to encourage employees to adopt best practices with a view to enriching the concept of the green economy. It has also rolled out 32 initiatives to save energy and its environmental endeavours were rewarded by clinching the coveted BGREEN Award as The Most Sustainable Government Entity in the region in 2014.

The RTA has also inked an agreement with Liberty Company to commission the test run of an electric bus in order to identify the impact of climatic conditions in the Gulf region on the performance of electric buses and assess the operational efficiency of batteries and air-conditioning systems under these conditions.

The operation of electric buses results in zero emissions as they are powered by electrically charged batteries and it is possible to set up solar-powered stations for the generation of electricity needed for bus operations. Compared with diesel-powered buses, electric buses are lighter in weight as they have no heavy engines or bulky fuel tanks and they generate minimal noise.

The trial run of the electric bus is intended to examine the compatibility of this type of bus with the Gulf region by assessing the ability of batteries to sustain the high load of air-conditioners. The experiment also seeks to identify improvements that can be introduced to these buses to make them fit for operation under the soaring temperatures of the region. This pilot operation of an electric bus in public transport is considered to be the first of its kind in the region.

RTA had already introduced eco-friendly buses fitted with Euro 5 engines with low emission levels and a diesel with sulfur content as low as 10ppm. ■



**The operation of electric buses results in zero emissions as they are powered by electrically charged batteries, and it is possible to set up solar-powered stations for the generation of electricity**

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**the RTA responded by launching the “Green Economy Award” in 2013 to encourage employees to adopt the best practices**

هيئة الطرق والمواصلات  
ROADS & TRANSPORT AUTHORITY

RTA

## ABOUT ABDULLA YOUSEF AL ALI



He is the CEO of RTA's Public Transport Agency, which is responsible for conducting detailed studies for designing, deploying, managing, operating and maintaining a public transport system integrated with other transit modes in Dubai. The Agency also assumes the responsibility of licensing mass transit routes & vehicles including public buses, taxis, school buses and other means of transport. He is also a member of RTA's Board of Directors.

# ETIHAD RAIL — BRINGING THE NATION'S VISION TO LIFE



## THE UAE'S NATIONAL RAIL NETWORK

- Developed in line with the UAE 2021 vision, creating a lasting legacy for generations to come.
- Creating a new means of transportation, revolutionising the country's economic and industrial landscape.
- Connecting borders, communities and centres of commerce and industry.
- Providing a vital link to the GCC, bringing long-term prosperity, efficiency and sustainability to the UAE and beyond.

# SUSTAINABLE TRANSPORT – A DRIVING FORCE FOR INDUSTRIALISATION

## THE UNDERESTIMATED EFFECT OF TRANSPORT INFRASTRUCTURE ON GDP

Transport services, including the combination of roads, vehicles and fuel, have served as a driver for economic growth in both emerging and developing countries. Unfortunately, the prevailing dynamics of this sector are unsustainable in that they contribute to several problems, from increased road accidents to congestion, air pollution detrimental to people's health, and climate change. In order to maximise the potential for transport services as a catalyst for growth in the future, strategies ensuring sustainability should be devised, encompassing features of efficiency, safety (including climate resilience), accessibility to all sectors of society (including women, rural communities and people with special needs), affordability and environmental soundness (clean and low carbon emissions).

In 2012, transport accounted for 23% of global CO<sub>2</sub> emissions, largely driven by road transport, which is responsible for about 75% of transport CO<sub>2</sub> emissions and grew by 64% against 1990 values. However, steeper increases between 1990 and 2012 were observed in the maritime and aviation sectors, with 66% and 80% growth rates respectively. According to projections by the International Energy Agency (IEA), this growth is likely to exacerbate human-induced greenhouse-gas emissions (GHGs). Moreover, transport's continued reliance on fossil fuels will make it the fastest rising source of GHG emissions, with adverse effects on climate change and human health. Air pollution from transport, specifically in the form of particulate matter, has been associated with respiratory and other health problems, especially in congested and dense urban areas. There is therefore a strong impetus to break the current link between transport and harmful emissions and to ensure more sustainable means of movement in the future.



A 10% increase  
of railway  
infrastructure leads  
to a 4% expansion  
of manufacturing  
per capita



By Dr.  
**Pradeep Monga**



## The link between industrialisation and transport

In 2009, UNIDO prepared a working paper entitled *On Track for Industrial Development*, which examined the impact of transport infrastructure on industrial development. One of the main conclusions is that transport infrastructure carries significant explanatory power for why some countries have succeeded in industrialising while others have not.

Specifically, the analysis showed that a 10% increase in railway infrastructure leads to a 4% expansion of manufacturing per capita – a significant effect by any means. From an industrial

perspective, if manufacturing contributes to around 20% of GDP, the 4% translates to an economic impact of 0.8%, which is not unreasonable from a long-term development perspective. Moreover, a 10% increase of the road network per land area, independent of it being paved or not, increases manufacturing by 3%. If paved, road infrastructure contributes to a 5% increase in manufacturing. Taken together, there is little doubt that transport infrastructure closely relates to industrialisation and is a precursor to economic development, job creation and lasting prosperity for all.



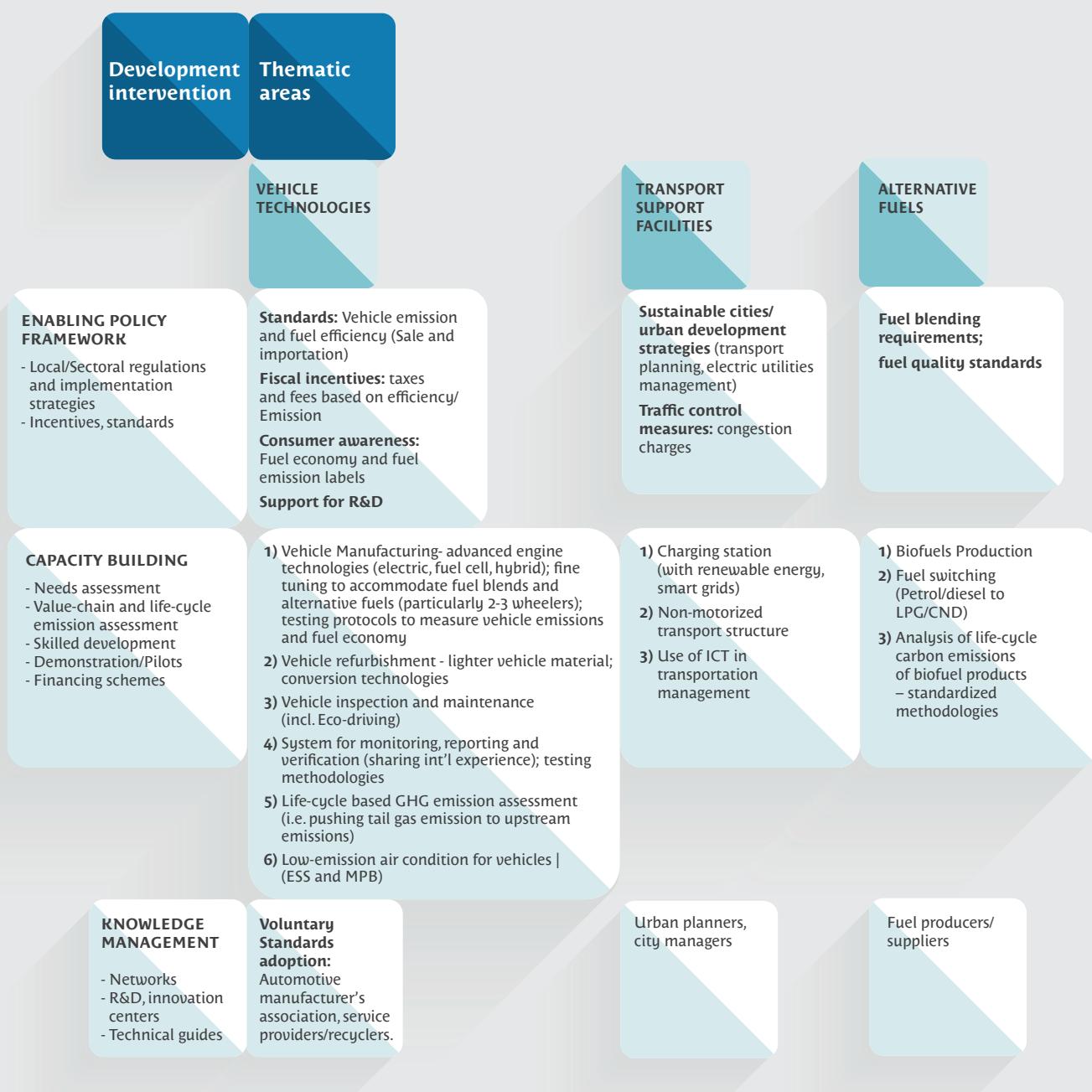
### UNIDO's strategy for sustainable transport and sustainable cities

The UN Secretary General has declared transport as one of the building blocks for sustainable development in his Action Agenda. The current sustainable-development goals (SDGs) have included sustainable-transport objectives as part of the indicators under the focus groups on SDG7: sustainable energy, SDG9: sustainable infrastructure, and SDG11: sustainable cities.

Recognising the importance of automotive manufacturing and industry and transport services as prime-movers for industrial development, UNIDO endeavours to contribute to this call for action by developing more systems for sustainable transport and sustainable cities.

UNIDO aims to promote low-emission transport that supports the sustainable industrialisation and urbanisation goals of its member states. These specific interventions will focus on fostering enabling policy frameworks, strengthening local capacities and enhancing knowledge and innovation. They will be conducted in the thematic areas of vehicle technologies, energy and transport infrastructure and alternative fuels, and contribute to the creation of sustainable cities. ◀▶

## UNIDO LOW-EMISSION TRANSPORT STRATEGY – Key areas of intervention



The low-emission transport programme hinges on the UNIDO Energy Branch's energy efficiency, renewable energy, and low-carbon technology programmes. Examples of UNIDO's energy projects related to sustainable transport include:

Improvement of vehicle fuel efficiency in China	Promotion of early and widespread take-up of electric vehicles and solar photovoltaic charging stations in Malaysia and South Africa	Promotion of cycling (non-motorised transport) in South Africa	Promotion of bio-fuel production and utilisation (to support fuel blending/ switching policies)	Eco-city and hydrogen three-wheelers in India
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## Sustainable transport in the future

The growing importance of transport in the global energy debate was demonstrated by its inclusion as a parallel session for the first time at the recently concluded Vienna Energy Forum 2015. The following represents some of the key messages that emerged from the session, focusing on sustainable transport for our common future:

- Accelerating the transition of transport systems towards a sustainable-energy and low-carbon economy will require further technological innovation, improved systems planning and enabling legislation and regulation. Financial strategies need to be in place to incentivise and enable the transition.
- While the future of vehicles is towards increased electrification, more readily forthcoming in Europe and other developed countries, with modest achievements in efficiency and quality of charging systems, the growth in vehicle stock will be largely in developing countries, where vast opportunities exist for increasing vehicle and fuel efficiency.
- To accelerate the transition towards a low-carbon transport system, specific approaches can include, but are not limited to, the promotion of: fuel efficiency; more efficient railways; urban planning public policies and zoning regulations; and electric mobility – shared mobility and the use of information and communication technologies (ICT) as well as intelligent transport systems (ITS).
- On the road to the UNFCCC COP21 in Paris this year, notwithstanding the contribution of transport to global fuel demand and corresponding emissions, ambitious targets must be set for reducing CO<sub>2</sub> emissions while increasing tonne-kilometres and passenger-kilometres travelled.



## Energy-Efficient Low Carbon Transport in South Africa

Sustainable transport has been identified as a low-hanging fruit in the achievement of major national policies and programmes on energy efficiency and conservation in South Africa. UNIDO and the South African National Energy Development Institute (SANEDI) are working together to unpack the potential of this growing sector, with the support of the Global Environment Facility. Over the next three years, these organisations will raise awareness and change mind-sets about low-carbon transportation, while simultaneously creating opportunities for studying, testing and demonstrating progress achieved in South Africa with regard to electric vehicles. This in turn will promote low-carbon cities and foster a national culture of energy efficiency, improving industry competitiveness and reducing harmful impacts on the environment.

ABOUT DR. PRADEEP MONGA



He is the Director and Special Representative on Energy at the United Nations Industrial Development Organization (UNIDO). An energy expert with over 30 years of experience, his primary responsibility is to provide strategic policy advice to UNIDO member states on sustainable energy and industrial issues. He leads an interdisciplinary team of energy experts, planners and networks of international energy technology centres to promote technical cooperation projects and partnerships in the field of energy efficiency, renewable energy and low-carbon technologies.



In 2012, transport accounted for 23% of global CO<sub>2</sub> emissions, largely driven by road transport

The project will promote energy-efficient and low-carbon transport through two main components; the first being the improvement of policy and regulatory frameworks for the use and local manufacturing of electric vehicles and non-motorised transport systems, including capacity building for relevant stakeholders; the second being the broader promotion of non-motorised transport in the cities of Durban and Johannesburg, including the development and demonstration of supporting infrastructure for electric vehicles. With a budget of USD 1.3 million over the next three years, the costs for the project are minimal compared to the potential benefits of revolutionising the transport sector in South African cities through the project's demonstrative capacity, with strong potential for up-scaling and long-term sustainability. Additional benefits of income and job creation, as well as environmental benefits such as a reductions in air and noise pollution are also anticipated in the long term. ■



# FUEL & PETROCHEMICALS

HIS EXCELLENCY  
SAIF HUMAID AL FALASI

GROUP CHIEF EXECUTIVE OFFICER,  
EMIRATES NATIONAL OIL COMPANY



The business objectives of national oil companies are aligned with H.H. Sheikh Mohammed bin Rashid Al Maktoum's Green Economy for Sustainable Development vision. With uncertainty remaining over the future path of oil prices, it is essential that countries take a holistic approach towards their energy-consumption policies.

From an environmental perspective, alternative sources of energy must be encouraged since traditional forms are continually

depleting. ENOC is at the forefront in introducing new concepts to the local market – such as the ENOC Green Station, CNG, ultra-low sulphur diesel, and the promotion of the use of green lubricants as alternative energy sources, amongst others. Through innovation and excellence, we will continue our high governance and operational standards in order to ensure that we enforce sustainable operations, and so contribute to the UAE's economic development.

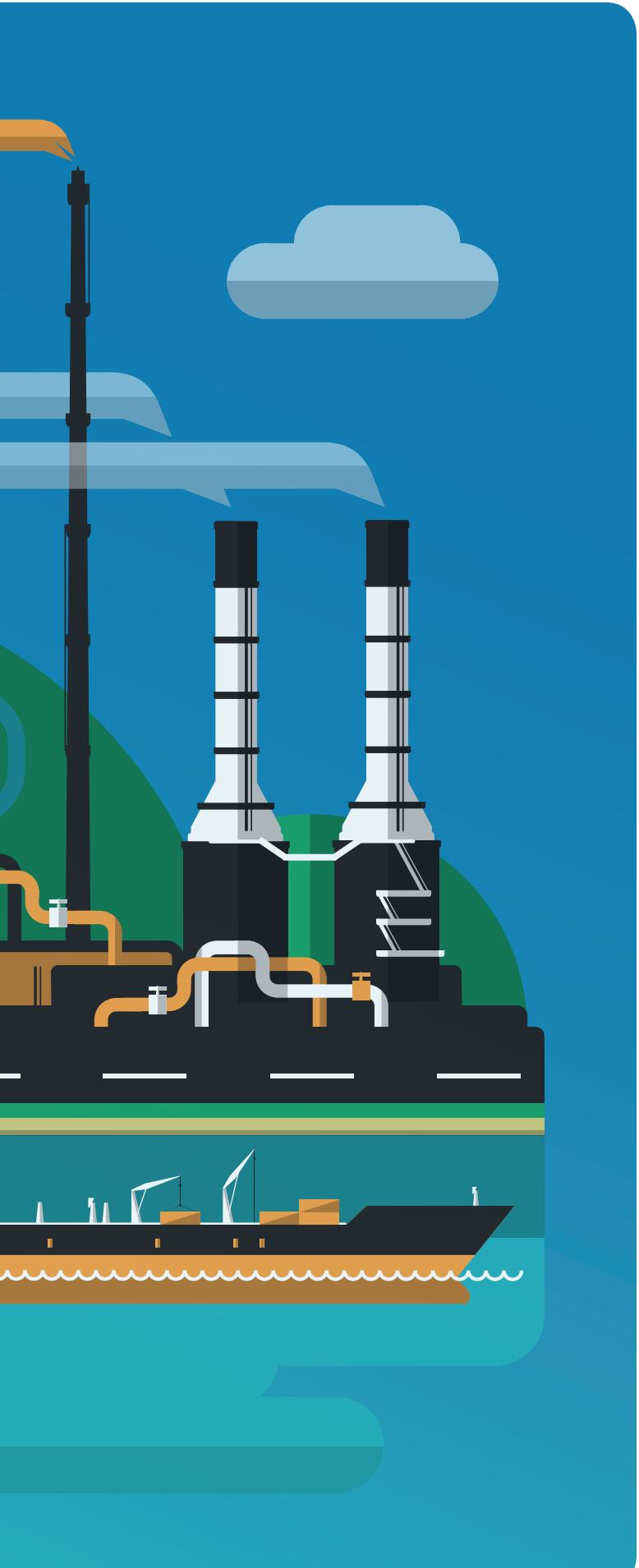
# THE UAE'S HYDROCARBON AND PETROCHEMICAL INDUSTRY

A SNAPSHOT OF A TRANSFORMING SECTOR



MAIN REPORT

By  
Dr. Saif Al Nasseri



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ADNOC is also involved in promoting and adopting new technologies such as renewable energy, carbon capture and sequestration (CCS) for CO<sub>2</sub>-enhanced oil recovery

The hydrocarbon value chain of the UAE is one of the major drivers of its economic and social development. The country has one of the largest proven reserves of oil and gas in the world as a whole, and within OPEC, placing the UAE as a key player in the world market in terms of production, processing capabilities and exports. The bulk of the country's hydrocarbons are located in the Emirate of Abu Dhabi, under the custodianship of Abu Dhabi National Oil Company (ADNOC), which is steered by the Abu Dhabi Supreme Petroleum Council (SPC). ADNOC's business activities span the full cycle of the value chain, from exploration to distribution.

Within the region, the UAE is a major crude oil exporter and a pioneer in liquefied natural gas (LNG) production and export. Products associated with gas processing, crude oil refining and petrochemicals such as liquefied petroleum gas (LPG) and paraffinic naphtha constitute an important portion of the UAE hydrocarbon production and export. Additionally, ADNOC's hydrocarbon products help drive and sustain the country's economic infrastructure development by providing fuel to electricity and water producers, as well as to the transportation and industrial sectors.

With a growing economy, came the Abu Dhabi Government's strategic decision to increase crude oil output to 3.5 million barrels per day by 2017.

The addition of sour gas field development to the value chain increased natural gas production despite several challenges accompanying such projects, such as the high hydrogen sulphide (H<sub>2</sub>S) content, advanced technology requirements and the remoteness of fields. At the beginning of this year, Al Hosn Gas, a partnership between ADNOC and US-based Occidental Petroleum Corporation (Oxy), successfully commissioned its operating facilities with a design processing capacity of 1BSCFD<sup>1</sup> of sour gas that eventually delivers around 500MMSCFD<sup>2</sup> of sales gas to the network. ▶

### Petrochemical industry and its entities

The petrochemical industry of the UAE contributes greatly to the country's manufacturing sector, with local petrochemical production meeting a significant portion of the domestic demand for plastics, providing an important source of material for the plastics industry.

The UAE is also a major producer of fertilisers. ADNOC is at the centre of the UAE chemical and petrochemical industry with two reporting companies:

- Ruwais Fertilizer Industries (Fertil) was established in 1980 as a joint venture between Abu Dhabi National Oil Company (ADNOC) and France-based TOTAL to manufacture fertilisers and market them locally and internationally. With the completion of a recent expansion project, Fertil has now two plants, each with ammonia and urea units.
- Abu Dhabi Polymers Company Limited (Borouge) was established in 1998 as a joint venture between Abu Dhabi National Oil Company (ADNOC) and Austria-based Borealis. Borouge is the leading provider of innovative and value-creating plastic solutions.

### Overview of ADNOC's business activities

The ADNOC Group of Companies represents a fully integrated oil and gas value chain, as the operations extend from exploration and production to petrochemicals and supporting services.

The development of UAE nationals is a core objective of ADNOC and its Group of Companies, therefore, ADNOC employs several learning and development practices that have a great impact on the development and integration of the Emirati workforce.

ADNOC and its Group of Companies have established a number of educational institutions, including the Petroleum Institute, ADNOC Technical Institute and the ADNOC Scholarships Program, to meet the future needs of the oil and gas sector. Today, these establishments, in collaboration with top international institutes, provide a steady stream of young graduates, who are knowledgeable, familiarised with the challenges and ready to play an active role in the industry. Furthermore, ADNOC is fostering the creation and dissemination of knowledge, which benefits the oil and gas industry through various research and development (R&D) programmes. 



**The UAE is also a major producer of fertilizers. ADNOC is at the centre of the UAE chemicals & petrochemical industry**

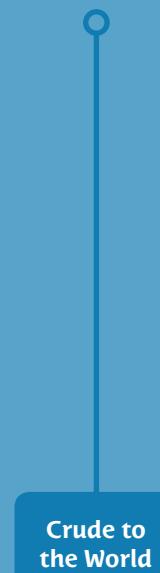
### Abu Dhabi's Hydrocarbon Network



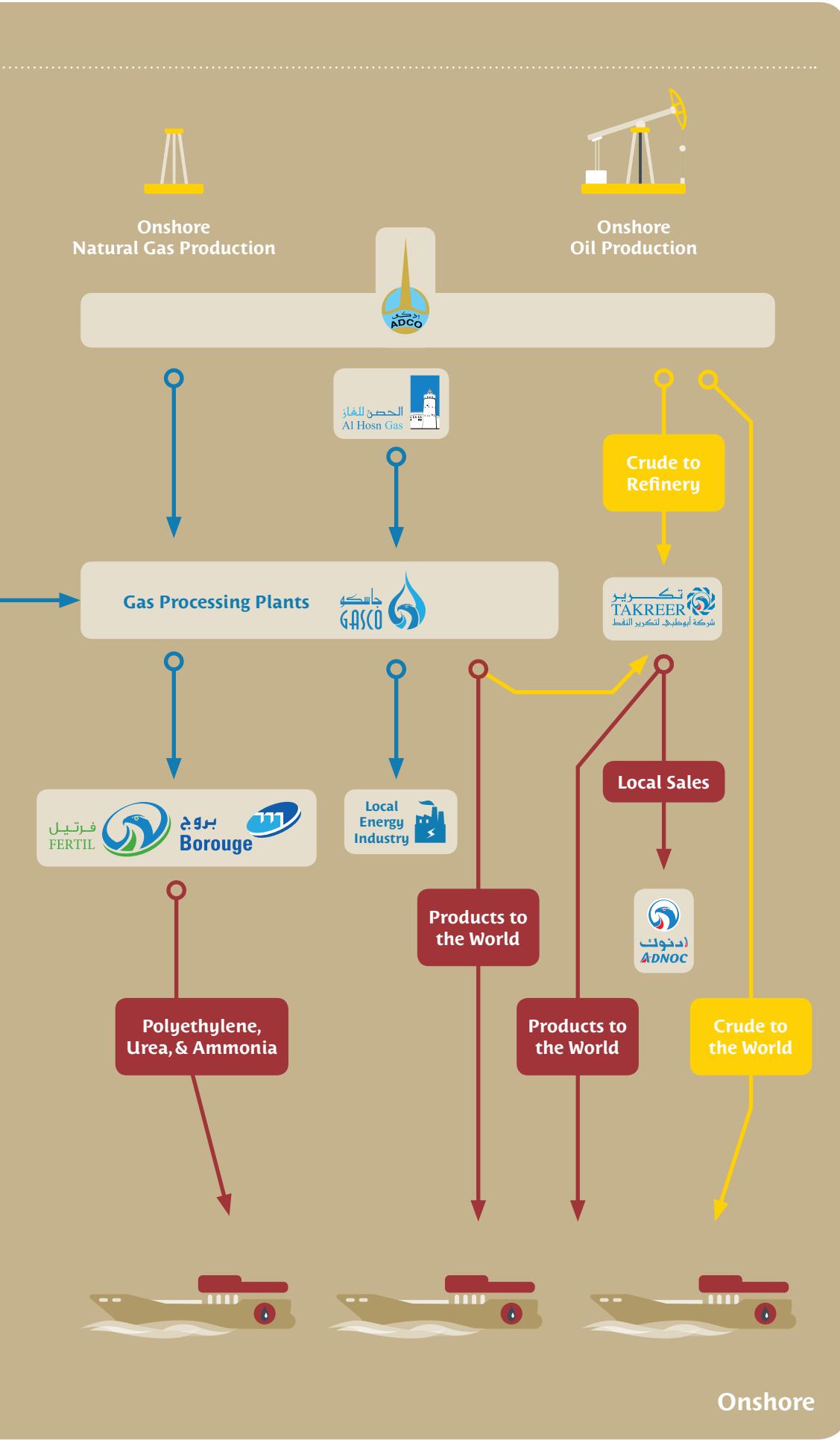
Offshore  
Oil Production



Offshore  
Natural Gas Production



Offshore



**ADNOC-Masdar Carbon  
Capture, Usage and  
Storage Joint Venture**

ADNOC is seeking to utilise CO<sub>2</sub>-enhanced oil recovery (CO<sub>2</sub> EOR) as part of a joint venture with Masdar through a pioneering Carbon Capture, Usage and Storage (CCUS) project. Located in Abu Dhabi, the capital of the United Arab Emirates, the project will dehydrate, compress and transport CO<sub>2</sub> captured from Emirates Steel Industries (ESI) to be used for enhanced oil recovery in ADCO's onshore fields. The project will utilise up to 800,000 tonnes of CO<sub>2</sub> annually.

## Sustainability initiatives in gas extraction and processing

ADNOC actively seeks to reduce its operational impact on the environment through several sustainability initiatives. These include:

**Climate Change:** ADNOC's strategy to manage the risks of climate change is focused on improving greenhouse-gas (GHG) management by increasing energy efficiency and implementing proven emission-reduction technologies. ADNOC also engages with policy-makers on climate-change issues at both national and international levels to make meaningful contributions.

**Energy Efficiency:** ADNOC has successfully established energy-management programmes across all gas production and processing sites and their gradual migration to importing power from the national grid is also part of the energy-efficiency drive.

**Cutting-Edge Technologies:** In line with the Government's emphasis on diversification, ADNOC is involved in promoting and adopting new technologies, such as renewable energy and carbon capture and sequestration (CCS) for CO<sub>2</sub>-enhanced oil recovery. The CCS project will be executed in partnership with MASDAR. ADNOC also develops and markets environmentally friendly products such as green diesel, natural gas for vehicles and high-performance propylene (PP) based products.



He holds the position of ADNOC Gas Processing Director and overlooks a key strategic part of Abu Dhabi's hydrocarbon value chain by leading the development of gas processing and transmission activities and assets. He serves as a board member for Abu Dhabi Water and Electricity Authority (ADWEA), Abu Dhabi Ports Company (ADPC) and Abu Dhabi Vocational Education & Training Institute (ADVETI), in addition to other strategic and leadership boards and committees. He is the Chairman of the Zayed Future Energy Prize Review Committee and an active member of the UAE-UK Business Council, as well as the Abu Dhabi-Japan Economic Council.

ABOUT  
DR. SAIF SULTAN AL NASSERI

## Applications of natural gas

In its commitment to Abu Dhabi's sustainable development, ADNOC has placed emphasis on securing natural-gas supplies to fuel the engine of the Emirate's economic growth, represented mainly in the form of power generation and the expanding industrial sector. ADNOC's petrochemical sector also uses natural gas as a feedstock in polymers and fertilisers production such as polyethylene, polypropylene, ammonia and urea. In addition, ADNOC is involved in the LNG business, exporting most of its LNG to Japan.

In transportation, natural gas has also emerged as an important alternative to oil-based liquid fuels. In 2011, ADNOC established compressed natural gas (CNG) stations to provide a cleaner fuel for transportation, with the aim of reducing the environmental impact.

## The role of natural gas in the energy mix

In realising Abu Dhabi's sustainability goals and Economic Vision 2030, natural gas has attained a crucial status in the energy mix. ADNOC through Al Hosn Gas has successfully commissioned the Shah project and is working towards the expansion of offshore gas supplies to the onshore network. Moreover, innovative enhanced oil recovery technologies will reduce gas injection requirements and increase production levels to meet domestic needs.

Natural gas will continue to play a central role in power generation. The government is also pursuing energy diversification plans to include nuclear and solar power generation in the energy mix. The government is placing a strong emphasis on energy-efficiency programmes in industrial, commercial and residential sectors, and is promoting demand-side management. ■



**With a growing economy, came the Abu Dhabi government's strategic decision to increase crude oil output to 3.5 Million barrels per day by 2017**



1| Billion Standard Cubic Feet per Day

2| Million Standard Cubic Feet Per Day



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نؤمن بقدرنا على إحداث الفارق أينما نمارس أعمالنا بالاستثمار في  
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COMMENTARY

## H.E. DR. MATAR AL NEYADI

**Undersecretary of the Ministry of  
Energy of the United Arab Emirates**

**A critical tool for economic  
prosperity and sustainability**



UNITED ARAB EMIRATES  
MINISTRY OF ENERGY

## THE UAE FUEL PRICE REFORM

**The introduction of the deregulation of Fuel Prices in the UAE in August 2015 has marked a key moment for energy policy in the UAE. This key decision has contributed significantly to position the nation as a pioneer in responsible energy policymaking across energy producers worldwide.**

**This step was a long-planned decision that has the potential to strengthen the UAE economy over the medium and long-term. More importantly, it aligns the nation with its strategic vision to preserve natural resources and increase long-term sustainability.**

**Energy policymakers in the UAE understood that, while energy subsidies can generate short-term benefits, they lead to greater adverse consequences, impeding market functions, creating artificial prices, decreasing sustainability and limiting the growth of clean energy.**

As the UAE is expected to continue to grow its economy at rapid speed, we also have to take into account the rising demand for energy, including transport fuels, our growth will add to over the coming decade. The deregulation of fuel prices in the UAE uses a new pricing policy that is linked to global prices: this is a key step to provide positive incentives for the economy to reduce energy consumption, and for the gradual switch towards more fuel-efficient vehicles, including electric and hybrid cars. In the long-term, this also opens up the market for more innovative fuel products, transport technologies and allows for more funds to be available for research and development in the area of clean energy, placing the UAE well ahead of the game in the wider region to make it a regional leader in cleaner, more sustainable energy use.

Managing and gradually reducing the UAE's energy consumption growth is also a key objective of our Ministry and our leadership's strategic vision, which aims to diversify the country's sources of income, strengthening the economy and increasing its competitiveness.<sup>4</sup> Around a quarter of the UAE's GDP is still linked to oil and natural gas, and ensuring these valuable natural resources are used in the most effective and responsible way possible is critical to building a strong, sustainable economy that is not dependent on government subsidies and preserves a share of our natural resource wealth for future generations.◆

## ENOC'S POINT OF VIEW:

**"As a wholly owned government entity, ENOC has been a strong supporter of the UAE leadership in their efforts to build a sustainable economic future for the country and promote energy-use efficiency, in line with the Dubai Integrated Energy Strategy 2030. This decision is part of the UAE government's vision for sustainable development, which is difficult to achieve if we don't start rationalising consumption. The new pricing scheme will bring the nation economic, social and environmental benefits that will be directly reflected in the communities we serve. For example, it will encourage the use of public transport and alternative fuels, thus reducing carbon emissions produced by the over-abundance of cars on the UAE roads."**

**His Excellency Saif Humaid Al Falasi,  
Group CEO, ENOC**



**Fuel prices closer in line with international price movements are a key step to provide positive incentives for the economy to reduce energy consumption**

## ABOUT H.E. DR. MATAR AL NAYADI



H.E. is the Undersecretary of the UAE Ministry of Energy, holds a Ph.D. in international law from the University of Edinburgh (1997). He has professional experience in leadership, international cooperation, international maritime law, management of international negotiations, climate change,

rationalization of energy and water consumption, impact of the prices of unconventional sources on oil and gas prices, the State's sovereignty on its natural sources and drafting legislations.

In May 2014, Dr. Matar assumed the position of Chairperson of the Board of Directors of the Gulf Cooperation Council Interconnection Authority (GCCIA). Dr Matar is also the UAE's Executive Member in the Gas Exporting Countries Forum (GECP), member of the Executive Office of the Organization of Arab Petroleum Exporting Countries (OAPEC), member of the National Emergency Crisis and Disaster Management Authority (NCEMA) and member of the Board of Trustees of H.E. the Minister of Interior's Award for Scientific Research.

H.E. is also the Chair of the Gasoline and Diesel Prices Follow-up Committee; Chair of the CDM (Clean Development Mechanism) Executive Committee; member of the Emirates Green Development Council; member of the Steering Committee of the UAE Ecological Footprint Initiative and a member of the Advisory Board of the College of Law.

H.E. Hamed Al Neyadi has authored a number of legal books which notably include 'Maritime Zones of the UAE', the 'Rules of International Treaties in Public International Law' and 'Documents in Public International Law'.

The UAE is well positioned to facilitate the switch towards more fuel-efficient, innovative vehicle technologies. Flagship institutions such as Masdar are providing the UAE with a unique pool of talent and innovative research that will form the basis of developing new technologies aimed at increasing our economy's efficiency while reducing energy consumption, including in the transport sector. The UAE has an advanced public transport system, and emirates such as Abu Dhabi and Dubai are in the process of further expanding public transport opportunities which over the coming decade will provide an ever-increasing range of public transport options beyond private vehicles.

Both within the GCC and the wider Middle East, the UAE leads this transformation into a greener, and more sustainable resource future. We are following in the footsteps of our founding father, Sheikh Zayed, who considered environmental protection and a sustainable use of our natural resources a basic principle to maintain the UAE's wealth for our children. We expect that our steps today to reform fuel prices will likely act as a model for other states in the region, which face the same energy developments as the UAE.

## ADNOC'S POINT OF VIEW:

Upon our request for comment, ADNOC stated that "the deregulation of fuel prices has been taken based on in-depth studies that fully demonstrate their long-term economic, social and environmental impact toward a fully comprehensive sustainable development. The resolution is in line with the strategic UAE Vision 2021 in diversifying sources of income, strengthening the economy and increasing its competitiveness, in addition to building a strong economy that is not dependent on government subsidies. This includes ensuring everybody in the society is engaged and involved. This step will put the UAE on a path with countries that follow sound economic methodologies. It is also anticipated to improve the UAE's competitiveness, while positioning the nation on international indices.

Deregulation of fuel prices would help in reducing fuel consumption, making people think twice when they use their means of transport and aiding in the preservation of natural resources for future generations. It will also encourage individuals to adopt fuel-efficient vehicles, including the use of electric and hybrid vehicles and public transport. According to the UAE Federal Transport Authority – Land & Maritime, the transport sector was responsible for 22% of the total greenhouse-gas emissions in the UAE in 2013, amounting to 44.6 million tonnes of carbon dioxide. Given this stark reality, increasing the use of public transport and reducing dependence on individual vehicle usage will have a positive impact in lowering carbon emissions. In parallel with that and as major driver for the UAE Economy, ADNOC has been exerting maximum effort towards zero-gas emissions in all of its operations, both onshore and offshore. But more is needed from other sectors and individuals. This is why more responsibility is to be assumed in fuel consumption and the use of various means of transportation."



### FOOTNOTES

- 1| Data from World Development Indicators, World Bank, downloaded from <http://databank.worldbank.org/> (retrieved August 2015)
- 2| Data from World Development Indicators, World Bank, downloaded from <http://databank.worldbank.org/> (retrieved August 2015)
- 3| Data from World Development Indicators, World Bank, downloaded from <http://databank.worldbank.org/> (retrieved August 2015)
- 4| E.g. see HE, Energy Minister, Suhail Al Mazrou's comments in Gulf News, 22 July 2015 "UAE fuel prices to be deregulated starting August 1" Online at <http://gulfnews.com/business/sectors/energy/uae-fuel-prices-to-be-deregulated-starting-august-1-1.1554150>.
- 5| UAE Ministry of Energy's announcement for August 2015 prices, available online at <https://www.moenr.gov.ae/en/knowledge-center/petrol-prices.aspx>.



FACT BOX

## WHAT ARE FUEL-SUBSIDIARIES AND WHY DO COUNTRIES SUBSIDISE?

Fuel subsidies are a fiscal tool used by governments designed to reduce the cost of fuels such as petrol, diesel, kerosene and LPG for consumers relative to what would have been their market price. Particularly in low and lower-middle income countries, fuel subsidies are often used to ensure and improve access to modern forms of energy, including electricity.

Fuel prices also account for an important share in the consumer basket, through their direct and indirect impact on such items as the cost of food and transport. In many developing countries, fuel subsidies are therefore a means of protecting citizens' incomes, and for macroeconomic inflation management. Fuel subsidies can also play a crucial role in incentivizing the creation of key economic sectors, since low-cost fuel can be an important competitive advantage for companies and industrial conglomerates to setup.

Most fuel subsidy programmes are many decades old, reflecting the difficulty of such programmes, once introduced, to be reformed over time. In a world that is geared towards a more sustainable use of energy, there is a unique opportunity for nations around the world to introduce a set of policies in the energy sector that promote a responsible reduction of the energy demand and the preservation of the natural resources.

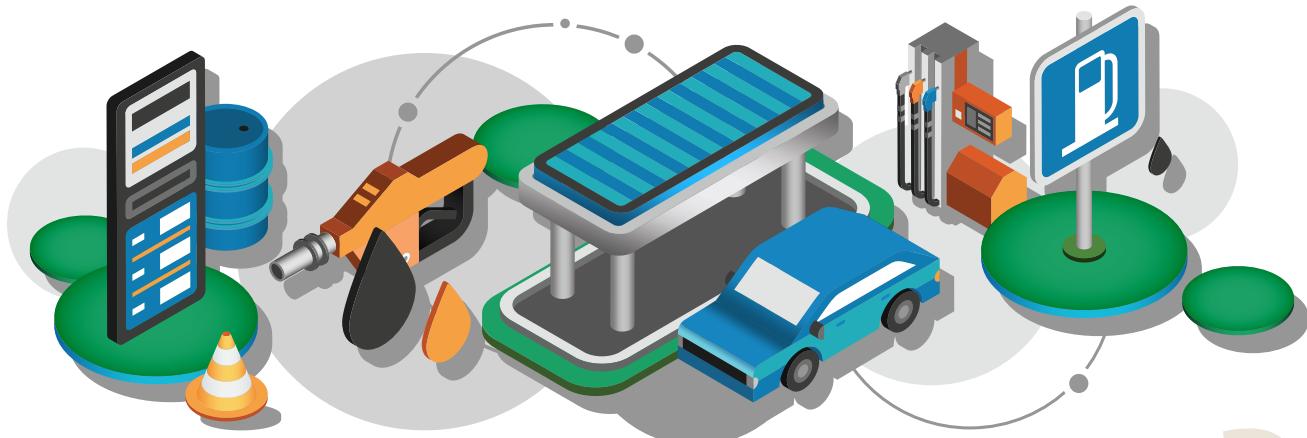
The reform of energy subsidies stands at the heart of energy policymaking. Introducing these reforms ends the negative impacts of energy subsidies that have led to creating artificial prices and an unsustainable energy demand. It opens the door to investments in clean and sustainable energy and introduces a demand-driven efficient consumption of energy.

The UAE's mechanism for adjusting prices is fair and transparent; it links domestic prices to international price movements, to be adjusted and announced on a monthly basis by a central government committee under the chairmanship of the UAE's Ministry of Energy, with committee members including the Ministry of Finance, and the CEOs of ADNOC Distribution and Emirates National Oil Company (ENOC).

The government's first price revision for August 1 raised gasoline prices by up to 24%, while prices for diesel fuel fell by around 29% in line with global market movements.<sup>5</sup> This is an important signal to local consumers, ensuring they also benefit from downward price movements, such as in the case of diesel. Prospects for relatively weak global oil prices over the coming year are likely to make price changes over the coming months comparably small, with the possibility of future price reductions if global prices continue to fall. For the UAE, this is a much more sustainable way forward than under static domestic prices. ■



**Fuel prices closer in line with international price movements are a key step to provide positive incentives for the economy to reduce energy consumption**





**INTERVIEW:  
H.E. SAIF  
HUMAID  
AL FALASI**

**CEO of the Emirates  
National Oil Company (ENOC)**

**An Analysis of the Fuel Market**



**ENOC's Chief Executive Officer, H.E. Saif Humaid Al Falasi assumed control in early 2015 and in this interview, he provides an overview of the national and international dynamics that influence ENOC's business.**



We hope that over the years the creation of a robust CNG refuelling infrastructure will force UAE transportation to use alternative and more sustainable fuel.

### **Q1: How is ENOC responding to the new realities of the oil and gas sector?**

**H.E. Saif Humaid Al Falasi:** ENOC is asking the same question that every other oil and gas producer is – how do we lock in market demand and thrive during a period of oversupply? However, inevitably, we at ENOC are also asking ourselves the additional question of whether we need to improve the efficiency of our operation or adjust our portfolio or not. We need to redirect our efforts from choosing to stay 'fit for USD 50 a barrel' to driving our capital and operating efficiency in order to preserve our margins and maintain the reinvestment rates necessary to grow production.

Following our tagline that we are the 'Energy Partner of Choice', we have aligned our strategy with the UAE's developmental vision and have pushed forward with a focus on economic diversification and sustainable growth. ENOC will continue to drive growth by using its supply chain strengths, coupled with innovation and positive customer service to deliver higher levels of customer satisfaction wherever we can. In addition, the company's strategy will focus on expansion, being driven by the exploration of new opportunities in new locations. We are actively following all possible avenues to do this, including through potential acquisitions, as we drive the company forwards. We will also continue to enhance our core business through the development of a strong workforce and by attracting, developing and retaining talent through the provision of training in new competencies and capabilities, in order to be the best we can be, both locally, and internationally.

### **Q2: What can the global oil and gas sector do to bring stability to what seems, currently, to be a very volatile industry?**

**H.E. Saif Humaid Al Falasi:** We need to understand that for downstream players, guaranteeing a buyer for their product is extremely important. The global challenge we face today is to hold on to existing customers and to find new ones. North American and European markets are shrinking to the point where they can no longer absorb all of the oil and gas refined in their region. Increasingly, refiners must look beyond their borders for customers. But what they inevitably find in global markets is fierce competition from the Middle East and other long-time exporters that have built large, modern refineries hoping to serve the still burgeoning Asian demand.

To compete effectively in this environment, downstream companies must look at more robust and long-term relationships with new and established customers, or seek out specific markets – even if they are small – to avoid head-to-head rivalries that have the potential to destroy their profit margins.

ENOC has been planning for an expansion programme for some time now, anticipating this very trend, and we hope that by the time we reach the golden jubilee of the UAE, during which the World Expo 2020 will have culminated, our expansion programme will have begun to bear fruit.

As producers, we need to be careful in the evaluation of our portfolios. We have to ensure that our operations fit well into the overall scheme of things so that the company's core strengths, our customer demographics, and preferences and skill sets, are not devalued. Only a few companies in the world will successfully shore up demand and improve margins by consolidating their strongest assets, yet in our view, it is an essential element for survival in the energy industry today.♦

### Q3: What are ENOC's strategic goals and objectives and how do they tie in with the UAE's sustainability development plans?

**H.E. Saif Humaid Al Falasi:** ENOC has always been a key player in supporting the UAE's social and economic growth. As the UAE focuses on its Vision 2021 – which is to ensure it is amongst the most advanced nations in the world – ENOC is working to achieve the visionary goals set by our leadership. A clear priority for ENOC is to support the Green Economy for Sustainable Development initiative announced by His Highness Sheikh Mohammed bin Rashid Al Maktoum, UAE Vice President and Prime Minister and Ruler of Dubai.

Our goal is to be a leading regional integrated oil and gas group, which is highly profitable and socially responsible towards its employees, the community and the environment. Working to meet the goals of the government, we continue to build enabling infrastructure such as the Falcon Pipeline, a 60-kilometre project running from the Jebel Ali Free Zone to the new Dubai World Central (DWC) airport.

As a responsible government entity, we place the highest emphasis on optimising resource-use and maximising productivity through strategic initiatives. This year we launched the ENOC Energy and Efficiency report to underline the initiatives undertaken across the ENOC Group to promote world-class energy and resource management practices, as well as complementing the UAE government's policy of promoting judicious use of energy resources.

Through our focus on corporate citizenship, ENOC's Corporate and Social Responsibility (CSR) department aims to formulate approaches to key areas of social concern, implementing

them throughout the group and communicating them with third party external stakeholders in order to carry them out successfully. The department also handles any other CSR-related disclosures and promotes dialogue with stakeholders at every level, as ENOC aims to be a positive and productive member of the community as a business, as an employer and as a corporate citizen.

To this end, ENOC has begun a number of new initiatives. The first of these is the Masiraty programme, in collaboration with the UAE Ministry of Social Affairs. It was established to develop the nation's human capital by offering candidates a three-month training programme designed to build their skills and make them more viable for our industry.

The 'ENOC Challenge' is a comprehensive training programme run on a yearly basis, in order to provide individuals with special needs or learning difficulties a unique opportunity to acquire vital professional skills and prepare them to join the workforce. Also, the 'Ramadan Campaign' provides ongoing support for the wider UAE community during the Holy Month. During Ramadan, ENOC distributed 65,000 meals to commuters in all its service stations. The campaign has additionally provided Iftar to more than 1,200 people in separate locations across Dubai and delivered 300 liquid petroleum gas cylinders to underprivileged members of society. The 'Ramadan Campaign' also successfully generated the donation of AED 1 for every vehicle registered at Tasjeel to support the Dubai Autism Centre.





ABOUT  
H.E. SAIF HUMAID AL FALASI



H.E. is the CEO of the Emirates National Oil Company (ENOC). He has a BSc in Petroleum Engineering from the University of Louisiana Tech, USA. He has nearly 30 years' experience in the oil industry at ADNOC and other major multinational companies, including Exxon, BP, JODCO and TOTAL. He became CEO of ENOC in March 2015.

**North American and European markets are shrinking to the point where they can no longer absorb all of the oil and gas refined in their region**

**Q4: Do you think alternative fuels can have the desired impact on the environment and sustainability in the UAE?**

**H.E. Saif Humaid Al Falasi:** The potential for alternative fuels is extremely strong and we have seen some very good results in the past couple of years, although they have been slow to make an impact. Our thrust to aggressively promote alternative fuels also falls under the framework of the Dubai Integrated Energy Strategy 2030. Our Compressed Natural Gas (CNG) initiative led by Emirates Gas (EMGAS), our business subsidiary, has caused EMGAS to be nominated as the sole implementing agency for the Emirates Authority for Standardisation and Metrology. We hope that over the years the creation of a robust CNG refuelling infrastructure will force UAE transportation to use alternative and more sustainable fuel. Future generations deserve to breathe clean air and the use of CNG will have a positive impact on air quality within the city, due to considerably fewer exhaust emissions.

**Q5: So much is being written about the Green Economy. What are your thoughts on it?**

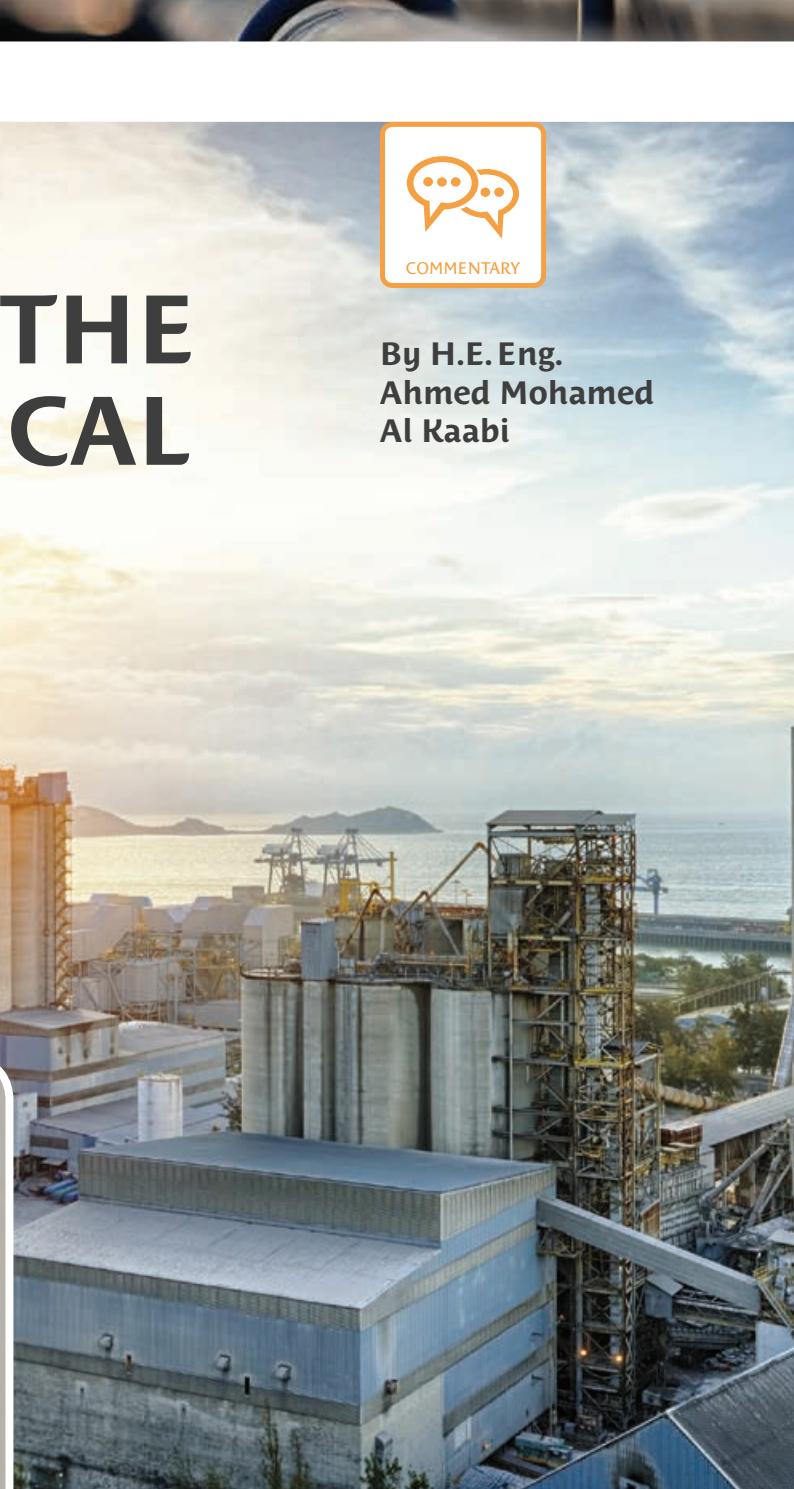
**H.E. Saif Humaid Al Falasi:** ENOC is committed to promoting green initiatives which support the 'Green Economy for Sustainable Development' vision of the UAE. An example is ENOC's Vehicle Identification Pass (VIP), a radio frequency identification (RFID) and vehicle identification (VID) based, fuel-retailing system at ENOC/EPPCO service stations with over 20,000 commercial vehicles registered. There was also the agreement between EMGAS and Dubai Municipality to treat land and sewage waste to generate compressed natural gas. These initiatives highlight the value of the company's innovative service and its ability to create efficient paperless procedures.

Today, the UAE is committed to diversifying its energy sources, exploring renewable energy sources to meet the growing demand from an increasing population and to support fast-paced infrastructure development. ENOC complements the nation's approach to growth through a focus on accelerating operational efficiency and productivity maximisation. At WETEX 2015, ENOC signed an MoU with DEWA to explore opportunities to build the infrastructure required for electric-vehicle charging stations and take advantage of our network to apply this extraordinary initiative. ■

# STRATEGIC BENEFITS OF THE PETROCHEMICAL INDUSTRY



By H.E. Eng.  
Ahmed Mohamed  
Al Kaabi



The Middle East and Asia (...) have become the fastest growing regions in terms of petrochemical production capacities, with annual growth rates exceeding 10% during the period 1980-2007

The petrochemical industry (PI) is known for the diversity of its products, as well as its ability to displace natural products. In fact, petrochemical products are beginning to compete with, and even excel over, natural products. In terms of economic value, this industry holds many future prospects due to its involvement in all areas of life.

It is noteworthy that the petrochemical industry is characterised by a number of features which promote the interests of Gulf countries, particularly its high generation of added value, its reliance on natural gas, which is available in the Gulf region (hence enabling petrochemical industry expansion) and the importance of the technological component in all stages of production. These factors may be explained as follows:



## UNITED ARAB EMIRATES MINISTRY OF ENERGY

### Second: PI size in Gulf countries compared to the global PI size

The reliance on available natural gas as a raw material for production is among the most important strengths of the petrochemical sector in Gulf countries. Moreover, petrochemical products are key inputs in many complementary industries, especially polyethylene, which goes into plastic products, such as plastic bags, the plastic packing of oils and chemicals, plastic boxes, pipes, tanks, greenhouses and medicine and cosmetics packaging.

Future expectations indicate positive growth in the long-term global demand for petrochemicals, especially in emerging economies such as China and India, which have recorded rises in the rate of consumption. This has led Gulf States to encourage investment in this area, to achieve global leadership in the supply of petrochemicals, as well as encourage the diversification of petrochemical products.

With the dawn of the third millennium, the centre of weight of the global petrochemical industry began to shift from the west to the east, particularly in the Middle East, China, India and other Asian countries which have become the focus of attention for investors as the best sites for PI investment. This has resulted in the reduction of the proportion of basic petrochemicals produced in the US, Western Europe and Japan, which has decreased to about 43% of total global production in 2007, down from approximately 80% of total global production in 1980, due to the operation of new PI capacities in other parts of the world. The Middle East and Asia (with the exception of Japan) have become the fastest growing regions in terms of petrochemical production capacities, with annual growth rates exceeding 10% during the period 1980-2007.

By the end of the first decade of the third millennium, petrochemical industries achieved remarkable growth, due to the expansion of research and innovations in this area. New materials were produced which could not be produced from other sources and sophisticated and previously unknown chemicals became available for industrial production. By 2010, global PI investments reached a total of USD 200 billion<sup>2</sup>. These new investments included infrastructure projects, green factories, export facilities and so on. 

### First: Value Added in PI Stages

The added value is defined as the increase in the value of a product created during a certain stage of production. The added value in PI stages varies between basic, intermediary and final production, but the value added in PI is high compared to the refining industry. For instance, the processing of an oil-barrel equivalent in the basic petrochemical industry, such as ethylene and propylene products, exceeds 12-fold what can be achieved in the refining industry. This added value rises to more than 44 times in intermediate petrochemicals. However, when an oil-barrel equivalent is converted into manufactured products that are ready for direct consumption, the added value exceeds 800 times what can be achieved in the refining industry.<sup>1</sup>



**The GCC (CCASG) intends to pump new investments into the petrochemicals sector for the value of USD 50.3 billion, with total investments expected to reach about USD 160 billion by 2020**

These investments are expected to grow to USD 500 billion by 2020<sup>3</sup>. In 2011 and 2012, the PI achieved global growth rates of about 3.8% and 2.6% respectively. The growth rate of the global PI slowed in 2012 as a result of the declining performance of global markets due to the recession in Europe and the decelerating pace of industry in general.

At the regional level, the Arabian Gulf area has emerged as a global hub for the production of chemicals and petrochemicals. This industry has seen rapid growth since 2008, becoming the largest industry in terms of work-force size after iron, mining and food industries. It currently employs more than 148,700 people directly, with each direct job leading to the creation of three additional jobs in related industries.

According to the Gulf Petrochemicals and Chemicals Association (GPCA), the PI sector will produce 190 million tonnes of petrochemical products by 2020. The Gulf petrochemical sector has been witnessing steady growth at an annual cumulative growth rate of 8% throughout the past five years, increasing its production from 37.2 million tonnes in 2008 to 67.6 million tonnes in 2014.

Petrochemical products manufactured in the Gulf region accounted for 80% of the total products in the region during 2014, which is 67.6 million tonnes according to GPCA estimates. In light of the anticipated growth of the petrochemical sector, by 50 million tonnes by the end of this decade, the PI sector in this region has promising potential. It is anticipated that exports will account for a large proportion of that growth.

GCC exports rely heavily on European markets and are expected to grow at an even faster rate. There is also a need to raise the level of exports to China by 8%, to enable the Gulf States to reach their maximum export potential.

Other economic reports revealed that the GCC (CCASG) intends to pump new investments into the petrochemical sector to the value of USD 50.3 billion, with total investments expected to reach about USD 160 billion by 2016<sup>4</sup>.

## ABOUT H.E.AHMED MOHAMED AL KAABI



H.E. appointed as Assistant Undersecretary for Petroleum Gas and Mineral Resources in the Ministry of Energy in United Arab Emirates since April 2015. Before that he was the General Manager of ADNOC Marketing International Company in Singapore. He was following the oil and gas business for ADNOC in Asia market.

## Third: Role of Technology in the Petrochemical Industry

Given the high cost of the technological component in the petrochemical industry, major international companies have resorted to the localisation of some petrochemical-product industries in developing countries that provide economic advantages, such as the proximity to cheap energy sources or major marketing centres and benefits from attractive investment terms or low taxes.

Petrochemical production technology is now widely available, although the cost is still high. It is in the best interest of all parties to transfer such technology to developing countries that are qualified to establish these industries.



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- 1| Dr. Hussein Abdalla, The oil industry in the era of globalization, 1996. Mentioned in Dr. Sabry Hassanein, globalization, Crown Prince Court, 1996.
- 2| Dr. Amir al-Rifai , the petrochemical industry Arab and international levels : the reality and the future, the Arab Energy Conference 2014
- 3| Dr. Amir al-Rifai , the petrochemical industry Arab and international levels : the reality and the future, the Arab Energy Conference 2014
- 4| Dr. Amir al-Rifai , the petrochemical industry Arab and international levels : the reality and the future, the Arab Energy Conference 2014

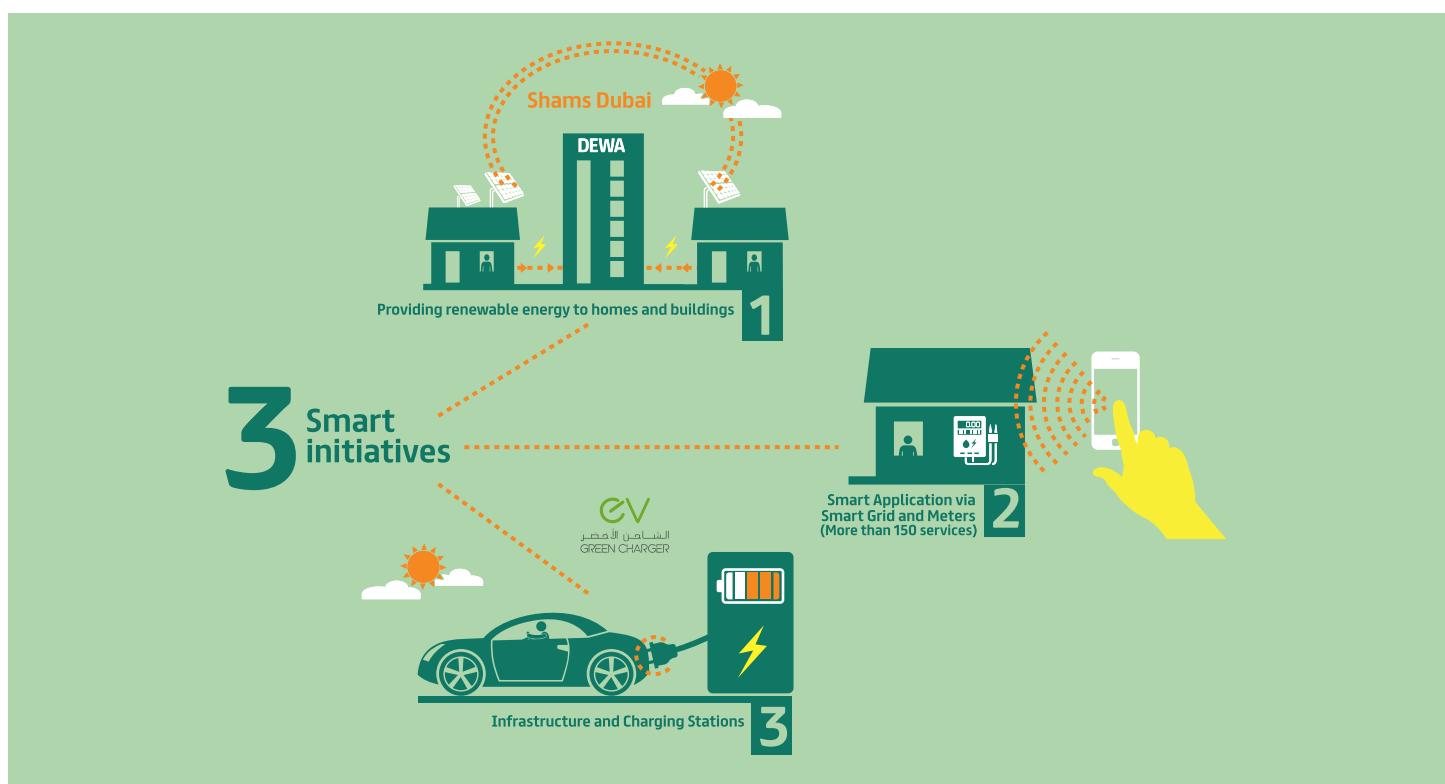


# TOWARDS A SMARTER FUTURE 'HADHREEN' – AT YOUR SERVICE

In support of the vision of **His Highness Sheikh Mohammed bin Rashid Al Maktoum**, Vice President and Prime Minister of the UAE and Ruler of Dubai, to make Dubai the Smartest City in the world, DEWA is fully committed to support Dubai's vision.

DEWA is fully prepared to turn this vision into reality by offering new smart initiatives and services to the community of Dubai through the Solar Panel drive which will supply all homes and buildings with renewable energy, the Smart Applications initiative which will give customers access to the Smart Grid and Meters, and the infrastructure and electrical car charging stations.

Together, we can make this vision a reality.



For installation details,  
contact your DEWA contractor.  
Or mail to [smartdubai@dewa.gov.ae](mailto:smartdubai@dewa.gov.ae)

DUBAI

**INITIATIVE 1:  
Shams Dubai**  
Connecting Solar  
energy to houses  
and buildings

**INITIATIVE 2:  
Smart Application**  
via Smart Grid  
and Meters

**INITIATIVE 3:  
EV Green Charger**  
Infrastructure and  
Electric Vehicles  
Charging Stations

For generations to come



# EDUCATING OIL AND GAS PROFESSIONALS

**ADNOC'S CONTRIBUTION TO A QUALIFIED WORKFORCE**



ARTICLE

Abu Dhabi National Oil Company (ADNOC)'s role in education goes back to the 1950s and '60s, thanks to the work of several of its then subsidiaries. But since the company's official establishment in 1971, it has incorporated them into the group, as well as a number of new bodies, too. Through this expansion process the company has been able to significantly improve its educational provision – something central to its core activities in the oil and gas sector.



[The] ADNOC Technical Institute (ATI) was created in order to play a major role in the Emiratisation of the workforce in ADNOC and its group of companies





Over a decade, more than 1,000 students of both genders have graduated [from the Petroleum Institute (PI)]



ADNOC's first educational initiative as the company it is today was the ADNOC Scholarships programme, established in 1974. The programme has run continuously since then, catapulting UAE Nationals into engineering and applied science-based careers, through sponsored higher education studies in globally recognised universities both in the UAE and around the world. After four decades, the programme has supported thousands of students, bringing them into the company to assist in its operations and activities.

Then in 1978, the ADNOC Technical Institute (ATI) was created in order to play a major role in the Emiratisation of the workforce in ADNOC and its group of companies. With ADNOC increasing its developments in upstream and downstream oil operations, there has been a need to raise the number of UAE nationals who undertake training at the ATI and then join the workforce. Today, ATI training focuses exclusively on the provision of technicians for the oil and gas industry in the UAE. In just over three decades more than 3750 trainees have graduated to serve the UAE, ADNOC and the wider oil and gas sector.

To provide another significant dimension to its educational role, ADNOC founded the Petroleum Institute (PI) in 2000. The university-oriented PI was established in order to provide the UAE's oil and gas sector – and the broader energy industry's – insatiable demand for highly educated and trained engineering graduates. The PI has positioned itself as a highly-respected higher education academic body that continues to support the industry thanks to its local and international accreditation. Having a unique oil and gas centred academic environment, it continues to serve in supporting an industry that remains the backbone of the UAE economy.

The PI started with five programmes offering a BSc in chemical, electrical, mechanical, petroleum engineering and petroleum geoscience. All placed a strong emphasis on technological education and research. Today, the institute offers bachelor and master degrees with plans to implement PhDs in the near future.►

Over a decade, more than 1,000 students of both genders have graduated from the Petroleum Institute (PI). The PI also has a special programme dedicated exclusively to female students, the 'Women in Scientific & Engineering Studies' programme (WISE). It encourages UAE women to take on more prominent roles alongside their male counterparts in the sector, and ultimately, therefore, within society itself.

The PI comprises more than 160 academic and research associates, including more than 20 UAE nationals of both genders, all with PhDs. This allows them to assist students in the conduct of their research and learning objectives. They are supported by more than 20 administrative staff. In addition, the PI is a hub for research and development, creating new programmes and centres now incorporated into the larger institutional structure. The key reason behind such research centres and programmes has been the need to address current and future challenges in the industry, whether upstream or downstream.



**More than 3750 trainees have graduated**

Major areas of research include: gas processing, with an emphasis on hydrogen sulphide and carbon dioxide removal; polymer processing; nanotechnology; catalysis and nano-particle development and processing; surface and pipeline integrity and reliability; enhanced oil recovery; process system engineering for simulation and optimisation; and many more.



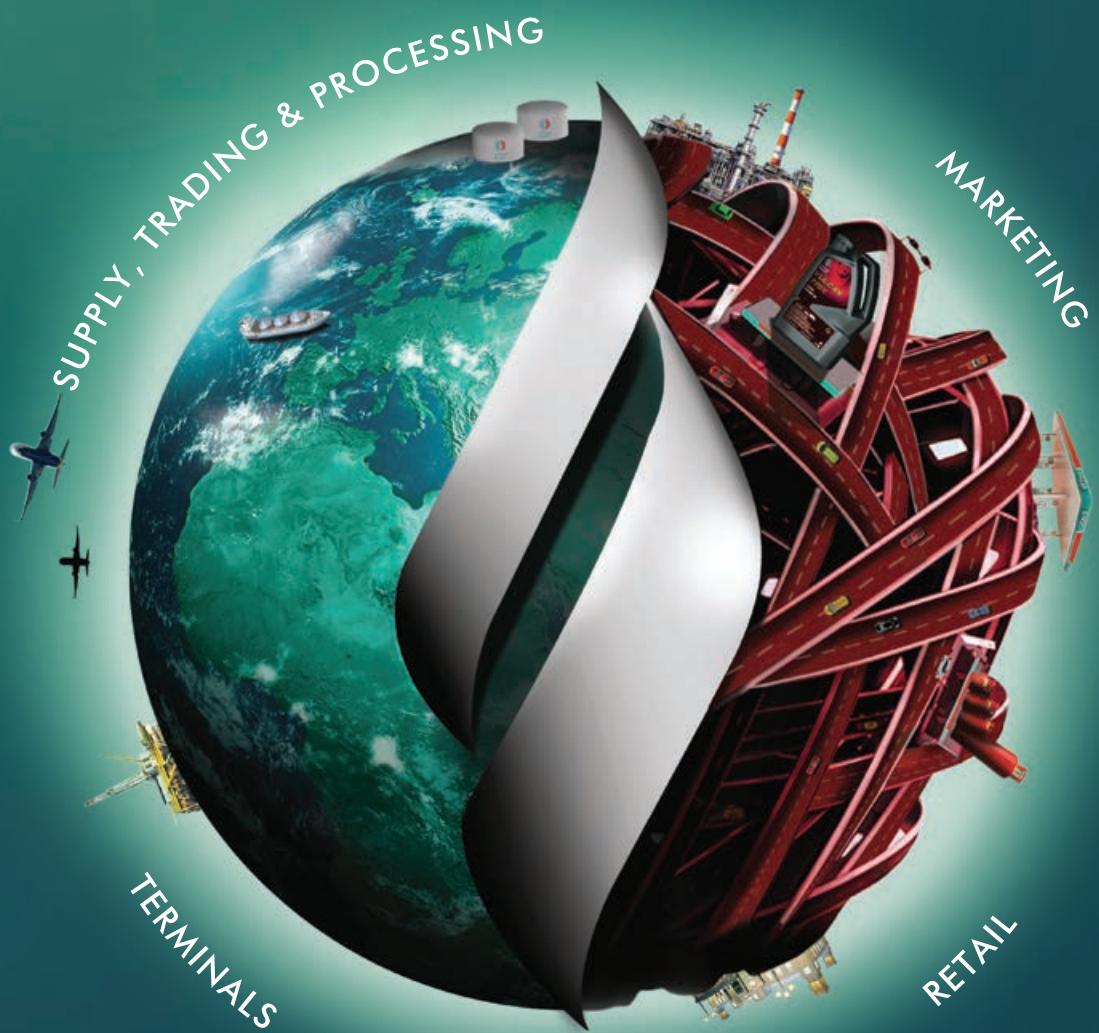
ADNOC went further by complementing its educational body with the establishment of a schooling system, which runs from KG to secondary for both genders. 'ADNOC Schools' was established in 2008, starting with its first campus in Abu Dhabi, followed by a new campus in Ruwais in 2011, Madinat Zayed in 2012, and finally in Ghayathi in 2014. ADNOC Schools' first graduation ceremony took place in 2010. Since then, these schools have witnessed the enrolment of more than 5000 students.

With a fully functioning targeted educational system in place, the establishment of the ADNOC Achievers Oasis programme was a natural extension to the curriculum by offering UAE students a summer activity programme. Launched in 2012, it provides training opportunities and industry-specific English language training courses for its students. ■



## 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 are the Energy Partner of Choice.





# ENERGY & WATER NEXUS

HER EXCELLENCY  
ENG. FATIMA AL FOORA AL SHAMSI  
ASSISTANT UNDERSECRETARY OF MINISTRY OF ENERGY,  
UNITED ARAB EMIRATES



Until recently, governments and utility companies all over the world have treated energy and water as separate issues. This is now changing and more of us realise that the future of both these resources is fundamentally linked.

Of course, the energy sector has always had to rely on water resources, either for direct use – as in the case of hydropower – or for cooling needs. But as demand for power grows, so will the pressure on water resources. For example, the World Bank estimates the global increase in energy demand to be 35% by 2035. The water sector is facing additional challenges, with continuing urbanisation and the growth of industry and agriculture adding to the burden.

This interplay between water and energy is especially relevant for the UAE – one of the most water insufficient countries in the world. There are few fresh supplies here, so we must use energy to produce potable water. For the UAE, water generation is sensitive to natural gas prices and when they rise, the cost of generating water does, too.

Having the ability to generate water at competitive prices and with minimal environmental impact is key for the UAE. The issue touches on all aspects pertaining to our country's continued development, including our food security.

Decision-makers are aware of the need to act responsibly and are rethinking the relationship between energy and water. One set of measures that has been implemented approaches the problem from the point of view of rationalisation and efficiency. Building codes have been introduced in some Emirates that require the efficient use of energy and water. In the agricultural sector, cutting down water-use is targeted through the use of drought-tolerant and salt-tolerant plants. A lot has been achieved in terms of water reuse.

Traditionally, water and energy generation in the UAE were coupled in an attempt to increase efficiency. This approach has worked well with natural gas-fired power plants and thermal desalination plants utilising synergies. With renewable energy technology in use already, added to nuclear power which will soon improve the UAE's energy mix, the need to decouple energy and water generation is currently being explored.

Developing water-efficient energy and energy-efficient water is not only important for the UAE now; it could serve as a platform to encourage innovation and promote the country as a technology leader in the future.



# THE ADSG ENERGY MANAGEMENT FLAGSHIP PROGRAMME: A GREEN LIGHT ALL THE WAY



By  
Huda Al Huqani

After its establishment in 2008, The Abu Dhabi Sustainability Group (ADSG) set out its mission as the promotion of “sustainability management in Abu Dhabi by providing learning and knowledge sharing opportunities for government, private and not for profit organisations” with the support of Environment Agency – Abu Dhabi.

The ADSG Energy Management Flagship Programme is at the heart of ADSG Strategy 2014-2019. The strategy report highlighted that the trends of diminishing resources, rising expectations and an ever-greater need for transparency are together posing challenges and providing opportunities for Abu Dhabi. Abu Dhabi's response is manifested in the Abu Dhabi Policy Agenda 2007-2008, the Abu Dhabi Economic and Environment Policy 2030 to be approved (the “2030 Visions”) and recently in the Abu Dhabi Plan. ADSG acts as a multi-stakeholder platform where all of its members work together to deliver outcomes according to the set action plan. With this in mind, the ADSG Strategy 2014-2019 concentrates on the integration of sustainability governance for greater impact.

Energy-use was identified as a key issue for all involved, which should be aligned with federal and local government objectives. To this end, ADSG developed the 2015 Energy Management Flagship Programme, designed to look primarily at the management of energy consumption. This was done for a variety of reasons. Firstly, it was applicable to all members, as few generate their own energy or have the potential to install renewable energy. Additionally, members hold significant real-estate assets and therefore stand to make significant savings from more efficient energy consumption practices. Thirdly, as Abu Dhabi Urban Planning Council’s Estidama programme’s studies demonstrate, energy management in many of Abu Dhabi’s existing buildings needs substantial improvement before they can be considered sustainable in any sense of the word.

Having launched numerous flagship programmes in the past, such as sustainability in procurement, ICT, labour practices and waste management, ADSG took lessons learnt into consideration when they developed the new programme. This meant that several key points needed to be included, such as ensuring that all members were involved and were able to draw on positive results from the programme as it progressed; that there were achievable and appropriate goals for ADSG; that there was no duplication of work with the programme; that it served a real and appropriate need that delivered practical and professional results for all; that sustainability and CSR professionals working in energy management were reached at an effective level; and that it followed clear, simple steps that were easily reproducible at every point. 

“

Most of the UAE’s potable water, or some 42% of the UAE’s total water requirements, comes from desalination plants

### The Development of the Flagship Programme

The ADSG team, led by Director Huda Al Houqani, outlined the content and objectives of the programme and the steps taken in development and initiation. These include the engagement of key stakeholders, where the Energy Institute (EI), the UK-based global professional body for the energy industry, was identified as the key partner because of their international expertise in running similar programmes. Thanks to their involvement, ADSG is able to offer certified training to energy managers participating in the programme. This is the first time this has been achieved in Abu Dhabi.

The hosting of an awareness and engagement session at the World Future Energy Summit (WFES) in January 2015 was also a key milestone that allowed for the inclusion of presentations from both the EI and a guest speaker from ENOC who dealt with energy-management best practice and how it will be implemented in Abu Dhabi. This was followed by the inaugural ADSG Sustainable Business Leadership Forum in February, at which the Energy Management Flagship Programme launch took place.

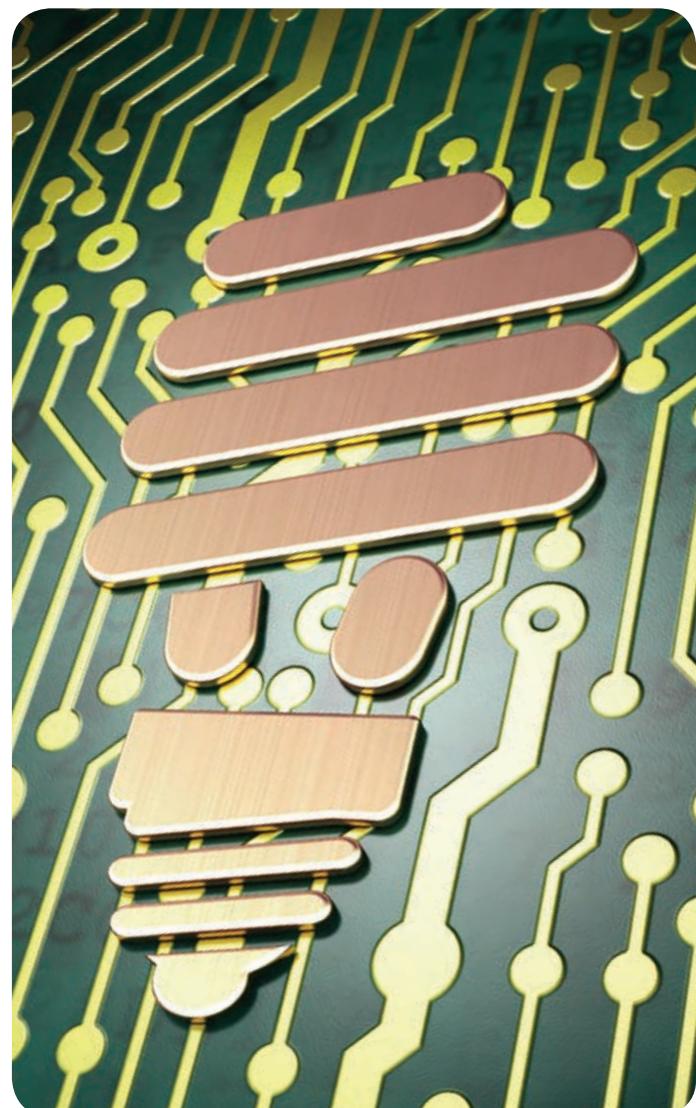
ADSG partnered with the Emirates Wildlife Society in association with World Wildlife Fund (EWS-WWF), who introduced their Sustainable Office Interactive Energy Efficiency Game, which takes users through the process of tracking, calculating and reducing energy consumption in a typical UAE office space. The aim of the game was to simulate challenges in energy management and inspire interest in the overall programme.

Nine organisations registered with the programme, designating 14 energy and facility management professionals as trainees for the five-day Continuous Professional Development (CPD)-accredited training with the EI, hosted by the Abu Dhabi Department of Transport in May. This specially developed course delivers the first level of a certified energy-management training course that includes an online learning component, a written exam, a project and practical instruction, with a tour of a plant room and office facilities so as to initiate an understanding of how to operate industry best practice. Currently, trainees are finalising their projects, which include energy audits of their respective facilities. The next stage will include an EI group webinar and a programme highlights report, to be issued at the end of the year.



She is the Director of Abu Dhabi Sustainability Group. She is a committed, inspiring and visionary leader. She has held many significant roles where her passion for the environment and sustainability ensured successful outcomes and results.

Prior to her current position, she used to work in Environment Agency – Abu Dhabi for more than 8 years, as Policy Planner. She helped in issuing a number of publications: "Working Towards Integrated Water Resources Management in The Emirate of Abu Dhabi" in 2002, An ArcGIS Database for Water Resources Management in Abu Dhabi Emirate, UAE" in 2005 and "The Water Management Challenges Faced by the Various Water Sector Users in the Emirate of Abu Dhabi, UAE" in 2005.



## Energy Management in Abu Dhabi, Looking Ahead

It is clear that Abu Dhabi needs to seriously address energy management and ADSG is playing a central role in developing member capability in this area. As recognised by the EI, energy management is perfectly placed to deliver immense benefits to an organisation, not only in overhead savings, but also in actual improvements in work practices. Currently, however, energy management is seen as a separate function and as a result does not receive the necessary time and resources that should be allocated. In practice, this means there are low levels of energy-management awareness on a day-to-day basis and consequently, it is often overlooked. Direct savings are therefore not made, despite being possible. There are many reasons why energy management has not been given the attention it deserves. One of them is the low price of energy in the Emirate. Another is the lack of understanding by top management of the opportunities to improve their bottom line through better energy management. There needs to be a new culture of resource efficiency that currently does not exist in most public and private organisations. A culture of resource efficiency will help prepare for a scenario where energy starts to reflect its true cost. Let us not forget that this year, Abu Dhabi reduced its electricity and water subsidies and the UAE removed its fuel subsidies. Under this scenario, energy-savings investments will deliver a more attractive return, making the business case for energy efficiency much more compelling for CFOs.

Before reaching out to the CFOs, the Flagship Programme is involving engineers and technicians. The courses that the Flagship Programme in Abu Dhabi is including as part of its development include: Energy Management for Technicians (three days); Energy Management for Engineers (10 days); and a bespoke course, Energy Efficiency in Combustion and Process Heat, which varies in duration according to the training programme of each company involved. Overall, there is a growing understanding amongst trainees and managers of the need for a growing focus on the improvement of energy-use techniques as an opportunity for both their organisation and themselves.

Energy Management is an issue that is not going to disappear any time soon. The knowledge that the ASDG Flagship Programme brings will contribute to creating a culture of energy efficiency by providing local examples that can be easily replicated by other organisations in Abu Dhabi. As the programme is expected to run until the end of 2015, when ADSG publishes its case studies in a report to share the findings of the programme, there is certainly going to be much more to discover and discuss in the coming months. ■



FACT BOX

## ADSG'S 5 STRATEGIC GOALS

### Goal 1:

Raise awareness and understanding of sustainability management and reporting principles and practices

### Goal 2:

Facilitate the adoption of sustainability management reporting practices

### Goal 3:

Provide a forum for experience sharing and learning about sustainability management and reporting practices

### Goal 4:

Support sustainability initiatives within Emirate of Abu Dhabi

### Goal 5:

Create opportunities for international cooperation and recognition

From: ADSG Booklet, Feb. 2015



**H.H. General Sheikh Mohammed bin Zayed Al Nahyan, Crown Prince of Abu Dhabi and Deputy Supreme Commander of the UAE Armed Forces:**  
**“water is more important than oil for the UAE”**

# A WATER BUDGET APPROACH FOR THE EMIRATE OF ABU DHABI



ARTICLE

By Dr. Mohamed Yousef Al Madfaei and Eva Ramos

## Water scarcity is driving reliance on non-conventional water sources

The Emirate of Abu Dhabi is located in an arid region where access to renewable natural water resources, mainly groundwater, is limited and threatened by over extraction. The construction of the first desalination plant in 1960 marked a milestone in the development of the Emirate, allowing Abu Dhabi to grow well above the limitations imposed by its water scarcity. Since then, its water policy has been largely based on supply-side management, always matching capacity to demand.

This approach has significant economic, environmental and social impacts. Desalination requires significant capital and operational expenditure on infrastructure and gas imports. In 2008, 51% of the fuel consumed in Abu Dhabi was used by the power and water sector. Desalination is an energy-intensive process and has a large impact on

the environment in terms of global warming, air pollution, marine pollution and loss of biodiversity. Desalination may also have an impact on health as the burden of disease from acute respiratory diseases can be exacerbated by air pollution from power plants.

On the positive side, it is necessary to acknowledge that desalination has enabled Abu Dhabi to increase its population 11-fold since pre-oil times, support its impressive economic development and avoid water-borne diseases. Access to water resources is also a key ingredient in the Government's strategy to diversify away from oil, an effort that will have large co-benefits to mitigate and adapt to climate change and to create employment and new sources of income for the citizens of the Emirate in a scenario of declining oil prices.

**“BUSINESS AS USUAL IS NOT AN OPTION, WE NEED TO CHANGE THE WAY WE THINK AND ACT ABOUT WATER”**





### Current consumption patterns in the Emirate do not reflect water scarcity

If, as mentioned by H.H. General Sheikh Mohammed bin Zayed Al Nahyan, water is more important than oil for the UAE, individuals and organisations have to start treating water as a scarce resource. However, current water-consumption patterns in the Emirate do not reflect this scarcity.

Groundwater withdrawals, used mainly for agriculture and forestry exceed 23 times the aquifer's natural recharge rate. Domestic water consumption per capita is one of the highest of the world. In 2013, it was 629 litres/person/day, including both indoor and outdoor use. This is three times the world average<sup>1</sup>. To place this figure in perspective, the average household consumption in the US in 2010 was 333 litres/person/day, in Australia in 2012, it was 200 litres/person/day and in Singapore in 2014, it was 151 litres/person/day.

Water consumption has grown steadily in the last decade and is expected to continue growing in parallel with increased economic and population growth, albeit more slowly. The Abu Dhabi Water and Electricity Company (ADWEC) has met average annual demand increases for water of 9.5% in the period 1998-2012 and has forecasted average annual increases of 3% for the period 2013-2030<sup>2</sup>.

Maintaining the current patterns of water-use will lead to the depletion of usable groundwater in a few decades and to double the volume of desalinated water required by 2030. This is unsustainable. ↗

### A water budget approach offers substantial benefits

The planning assumption today is that Abu Dhabi will meet its future water demand by increasing supply. The water budget approach wants to change this. Currently, our domestic consumption per capita is one of the highest in the world at three times the world average. If Abu Dhabi can reduce water consumption and achieve the world average, the Emirate will be able to triple its population and still produce the same volume of water for domestic consumption as it does today.

**The water budget approach offers substantial economic and environmental benefits in term of reduced social costs:**

The fiscal burden linked to investment in costly infrastructure and subsidies to water consumption;

The burden of disease from respiratory diseases linked to emissions of air pollutants;

The cost of global warming linked to emissions of greenhouse gases into the atmosphere;

The loss of biodiversity linked to discharges of brine into the Arabian Gulf.

### Adopting a water budget approach will require a four-pronged approach

A water budget is an accounting of the water resources within a geographical area. Like a financial budget, a water budget includes the sources and quantities of water income (rain, groundwater, etc.); the water savings (storage); and the water expenses (water uses). A water budget could provide the necessary information to set a cap on the water available for consumption across sectors at a sustainable level.

**Adopting a water budget approach will require a four-pronged approach:**

Quantify a sustainable water budget for the Emirate of Abu Dhabi

Agree on an allocation policy

Study options for efficient allocation of the water budget across competing sectors

Align water-use with the water budget

#### ABOUT DR. MOHAMED YOUSEF AL MADFAEI



He is the Executive Director of the Integrated Environment Policy and Planning Sector at the Environment Agency - Abu Dhabi.

#### ABOUT EVA RAMOS



She is the Director of Environmental Analysis and Economics Division, Integrated Environment Policy and Planning Sector at the Environment Agency – Abu Dhabi.

i

#### Quantify a sustainable water budget at an aggregated level for Abu Dhabi

Quantifying a sustainable water budget at an aggregated level for Abu Dhabi will require a thorough analysis of water supply and demand to develop a water budget model.

Calculating water supply includes an assessment of current supplies and the potential availability of new water. Current supplies include groundwater and desalinated water. Additional supplies will look at the potential of sources such as various types of reuse, bulk external supply, distributed rainwater harvesting and alternative technologies such as air to water.

Calculating water demand includes an aggregation of water requirement by sectors. Current demand includes five sectors: agricultural, municipal, business, industrial and domestic. The analysis also considers unaccounted for water, including technical and commercial losses.

The study should accommodate the future demand resulting from population growth and economic diversification within the water budget.

ii

#### Study the options for the efficient allocation of the water budget across sectors

Once the water budget model is available, it will be used to test the impact of various interventions to ensure an efficient allocation of the water budget across sectors. The information will be used to develop a set of realistic future water budget scenarios to make policy recommendations.



Once the water budget model is available, it will be used to test the impact of various interventions to ensure an efficient allocation of the water budget across sectors

### iii Agree on a water allocation policy to optimise water use

Once the range of possible water budget scenarios is well-understood, annual caps and a water allocation policy across sectors could be agreed by stakeholders and approved by the Abu Dhabi Executive Council.

Any recommendation regarding water allocation across different uses would need to consider economic, social, environmental, regional and technical factors such as network penetration as well as the social, cultural and operational risks associated with the consumption of different water types with different quality levels.

### iv Align water use with the water budget

Once the available water has been allocated across sectors, users would need to commit to using water as efficiently as possible. In parallel, the Government would need to deploy a range of public policies to accelerate behaviour change and the uptake of water-saving technologies and build support for the water budget approach.

## Adopting a water budget approach will require debate and agreement on the meaning of reasonable demand.

Article 30 of Law No. 2 of 1998 Concerning the Regulation of the Water and Electricity Sector establishes that ADWEC should provide sufficient production capacity to ensure that, at all times, all reasonable demand for water in the Emirate is satisfied.

The water budget offers an opportunity to debate and agree on what reasonable demand means in a water-scarce country.

Abu Dhabi can use this opportunity to meet increasing demand not only by increasing supply, but also through being more efficient, more productive and more competitive in the ways it uses water so that consumption patterns reflect water scarcity and water demand becomes a reasonable demand. ■



### FOOTNOTES

1| Statistical Centre Abu Dhabi (2014): Abu Dhabi Statistical Yearbook 2014 [http://www.scad.ae/SCADDocuments/SYB-2014\\_V1.1\\_EN.pdf](http://www.scad.ae/SCADDocuments/SYB-2014_V1.1_EN.pdf)

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Australian Bureau of Statistics (2013): Information Paper: Towards the Australian Environmental-Economic Accounts. <http://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/4655.0.55.002Mainpercent20Features42013?opendocument&tabname=Su>

2| Abu Dhabi Water and Electricity Company (2013), Winter 2012 / 2013 Electricity and Water Demand Forecast. <http://www.adwec.ae/documents/ppt/ADWEC per cent20Winter per cent202012 per cent202013 per cent20Demand per cent20and per cent20Capacity per cent20WEBSITE per cent20Presentation per cent20026.pdf>

# SOLAR THERMAL ENERGY WITH STORAGE

## THE FUTURE OF SUSTAINABLE DESALINATION



ARTICLE

By

Rayan K. Kassis

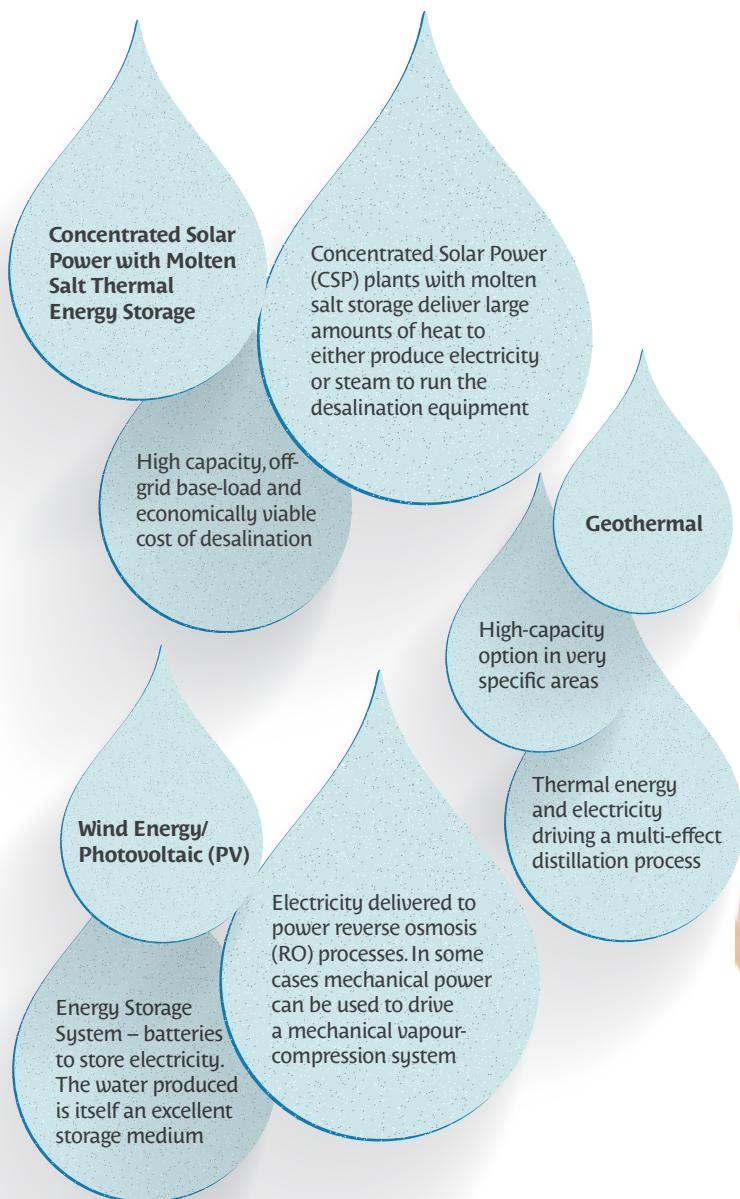




**the MENA region accounts for approximately 38% of global desalination capacity**

Desalination accounts for the vast majority of drinking water in the Middle East and North Africa (MENA). With over 21 million cubic metres per day (IRENA-ETSAP Tech Brief I12 Water-Desalination 2012), the MENA region accounts for approximately 38% of global desalination capacity. This figure is set to jump to over 110 million cubic metres per day by 2030, consuming over 122TWh of electricity annually. This represents three times the current demand and poses a significant challenge to policy-makers. The only way to meet this demand without a massive increase in fossil-fuel usage is by deploying significant renewable energy capacity for desalination, of which solar energy with energy storage shows the most promise in regards to the lowest cost of water

**There are three main technologies that are well-suited for desalination in the GCC given the availability of abundant sunshine and wind energy. These include the following:**



Of course there are challenges, of which the most important is resolving the intermittency of power to utilise the desalination assets to their full economic potential. Although there are several promising areas along the Red Sea that might be suited for geothermal applications, the greatest opportunity for renewable energy-based desalination capacity will be powered by solar and wind energy. Stand-alone wind energy and solar PV have promise in several areas, but face the challenge of intermittency and cost-prohibitive energy-storage options using battery technology. CSP with molten salt provides a high capacity option that is well-suited for desalination in the region. Combining a CSP molten salt base load plant with a reasonably sized PV component is an attractive solution that further optimises seasonal fluctuations in solar intensity and delivers the lowest available cost of water.

To demonstrate the applicability of such a plant, we have looked at several test cases in the GCC based on estimated direct normal irradiance (DNI) and availability of land. **Let us start with some basic assumptions:**

**DESALINATION OUTPUT**  
30,000m<sup>3</sup>  
per day

**ANNUAL SOLAR DNI**  
1,800kWh/m<sup>2</sup>  
(Gulf conditions) –  
2,200kWh/m<sup>2</sup>  
(Red Sea conditions)

**DESALINATION EQUIPMENT**  
Flexible depending  
on economics  
and salinity

#### FACT BOX

## ABOUT ESOLAR

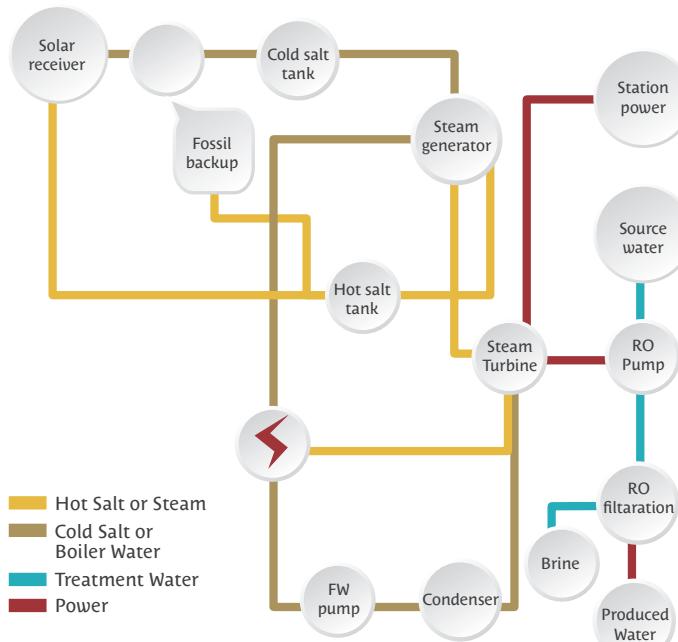
eSolar Inc., founded in 2007 and based in Burbank, California, develops solar collector system (SCS) technologies suitable for concentrated solar-thermal power towers. These technologies significantly reduce the cost of delivered thermal energy for power generation and process heat applications.

Since its inception, eSolar has developed multiple generations of SCS that are comprised of heliostats and associated control and calibration systems that focus and concentrate solar heat flux onto a steam or molten salt receiver. eSolar's SCS is compatible with our signature scalable and modular solar fields as well as large single-tower configurations.

eSolar has simultaneously contributed to solutions for the solar receiver system (SRS) working in concert with industry leading receiver suppliers such as B&W, Victory Energy and Aalborg CSP. This has given us the capability to provide an integrated SCS/SRS system. Prior investments and efforts have led to the commissioning of two pilot plants to date in the US and India, providing invaluable experience in validating our design approach and operation of multiple, modular solar fields. eSolar has been selected as the solar field supplier for the Sundrop Farms project in Port Augusta, Australia. The Sundrop Farms project is a 20-hectare greenhouse where tomatoes are grown with solar power and desalinated water.

In addition to its headquarters in Burbank California, eSolar operates regionally out of Dubai in the United Arab Emirates.

## Thermal and/or electric power



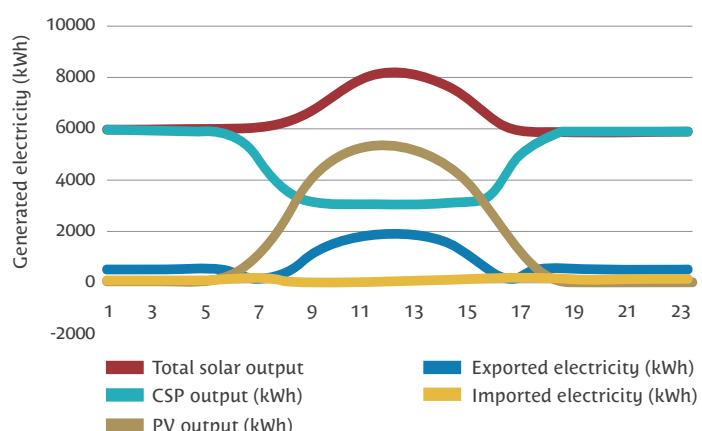
## ABOUT RAYAN K. KASSIS



He is the Vice President of Business Development MENA Region, eSolar. He has over 15 years' experience in the power-generation sector, including conventional and renewable energy projects across Africa, India and the Middle East. He is a graduate of George Mason University in Fairfax, Virginia.

On a typical day, the system would take advantage of PV capacity during the day and operate the CSP molten salt plant at maximum capacity to deliver power throughout the night. Although the sizing and costs of the plant will vary based on the solar DNI intensity, a plant configuration exceeding 90% plant capacity is achievable and offers operators a highly flexible solution that ensures the highest use of the desalination equipment, ultimately resulting in base-load daily delivery of 30,000m<sup>3</sup> of water at lowest levelised cost.

## Typical hybrid CSP/PV operation



Hybrid CSP/PV systems provide operators with additional flexibility to maximise capacity and lower the cost of energy. Based on our estimates, depending on favourable Solar DNI conditions, we can today achieve a levelised target of less than USD 1 per cubic metre – well within the range of current costs of desalination in the region. This is a proven and achievable approach to help solve the major water challenges in the Middle East. ■



[global desalination capacity] (...) is set to jump to over 110 million cubic metres per day by 2030, consuming over 122TWh of electricity annually

# RESEARCH AND DEVELOPMENT FOR EFFICIENT AND RENEWABLY POWERED SEAWATER DESALINATION

MASDAR INSTITUTE PARTNERS WITH LEADING INTERNATIONAL COMPANIES IN DESALINATION RESEARCH



By Dr.  
Steve Griffiths

The Middle East and North Africa (MENA) region contains approximately 66% of the world's proven crude oil reserves and 6% of the world's population, but only about 1.4% of the world's fresh water supply. Therefore, MENA countries, particularly the Gulf Cooperation Council (GCC) countries, rely extensively on desalination to meet their potable water needs. GCC governments plan to build 14 million cubic metres per day of new desalination capacity by 2020 to meet peak water consumption, which is projected to grow by more than 9 million cubic metres per day in the same timeframe.

This new desalination capacity will be added to an existing capacity of 19 million cubic metres per day of which 80% is based on thermal technologies that rely extensively on the combustion of fossil fuels. This use of fossil energy for clean water production is problematic in light of the region's increasingly scarce supply of cheap natural gas and the environmental and opportunity costs of burning oil products. Hence, energy-efficient desalination technologies powered by clean and renewable energy sources are needed.

In response, Masdar and Masdar Institute have initiated research and demonstration collaborations with international partners engaged in the Masdar Renewable Energy Desalination Programme, which was officially launched in 2013. The collaborations are aimed at achieving innovation in all aspects of energy-efficient and renewably powered desalination. The benefits to the UAE from the research and demonstration work will ultimately be desalination systems that (1) are more energy-efficient than current state-of-the-art systems, (2) can be powered by 100% renewable energy sources, (3) have minimal environmental impact and (4) are reliable, robust, bankable and suitable for UAE seawater and environmental conditions. Each of the research collaboration topics targets a critical challenge that must be addressed if these benefits are to be fully realised. 

The research collaboration involving ENGIE's Middle East Lab and Suez Environment focus on selecting the most practical and economical photovoltaic (PV) and solar-thermal energy technologies to supply a full-scale seawater reverse osmosis (SWRO) facility with locally produced renewable energy. In addition, novel strategies, such as storing desalinated water rather than electricity to deal with solar intermittency, are being investigated. The overarching goal is to develop an optimised design of a solar-energy-powered SWRO desalination plant that will translate into an operational demonstration facility.

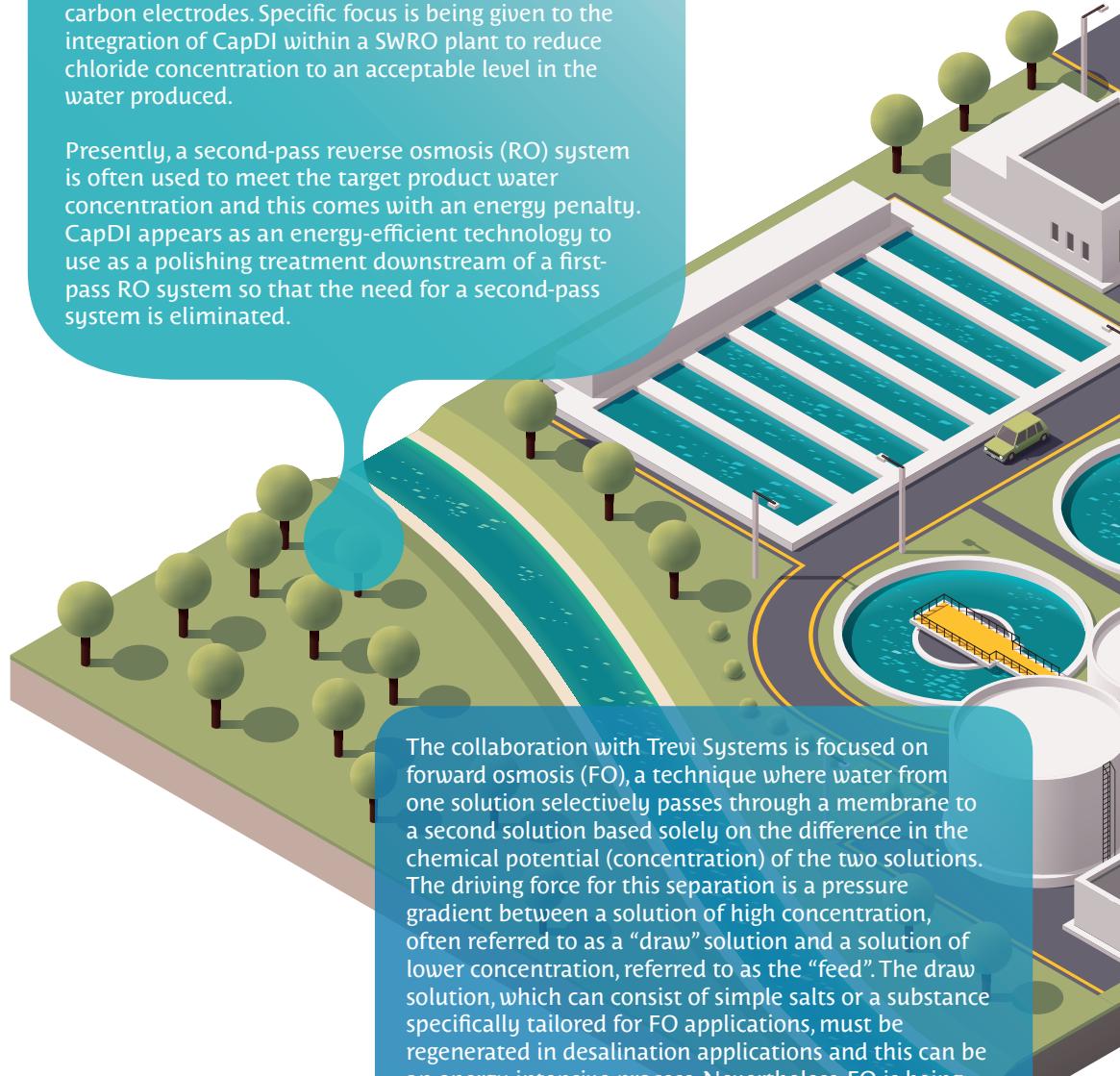
**The collaboration with Veolia** is focused on evaluating the current performance and potential enhancements for Capacitive Deionisation (CapDI) technology, which is used to deionise low-salinity water by applying an electrical potential difference over two porous carbon electrodes. Specific focus is being given to the integration of CapDI within a SWRO plant to reduce chloride concentration to an acceptable level in the water produced.

Presently, a second-pass reverse osmosis (RO) system is often used to meet the target product water concentration and this comes with an energy penalty. CapDI appears as an energy-efficient technology to use as a polishing treatment downstream of a first-pass RO system so that the need for a second-pass system is eliminated.

“

**The Middle East and North Africa (MENA) region contains approximately (...) 1.4% of the world's fresh water supply**

The collaboration with Trevi Systems is focused on forward osmosis (FO), a technique where water from one solution selectively passes through a membrane to a second solution based solely on the difference in the chemical potential (concentration) of the two solutions. The driving force for this separation is a pressure gradient between a solution of high concentration, often referred to as a "draw" solution and a solution of lower concentration, referred to as the "feed". The draw solution, which can consist of simple salts or a substance specifically tailored for FO applications, must be regenerated in desalination applications and this can be an energy-intensive process. Nevertheless, FO is being actively investigated as a cost-effective alternative to RO. The overarching goal of the project is to develop, test and devise a process for manufacturing forward osmosis membranes that accommodate regionally high ambient and seawater temperatures.



GCC governments plan to build 14 million cubic metres per day of new desalination capacity by 2020 to meet peak water consumption



Finally, the collaboration with Abengoa is focused on the treatment of brine from desalination plants using Membrane Distillation (MD), which is a thermally driven separation process in which only vapour molecules transfer through a porous hydrophobic membrane. Because the technology does not rely on overcoming a pressure gradient that increases with salt concentration, very saline brine-treatment streams can be processed. This research is specifically aimed at reducing scaling and fouling in MD modules. Different combinations of membranes and brine feeds are being evaluated under the same operating conditions as are present in an operating desalination plant. Characterisation of MD membranes and the scaling formed at their surface under the targeted working conditions supports the development of operating procedures that minimise scaling in the modules.

ABOUT  
DR. STEVE GRIFFITHS



He is Vice President for Research and Associate Provost at the Masdar Institute of Science and Technology. He leads the Institute's research activities, which include energy, water and environment, microsystems and sustainable engineering systems.

A shift is underway in the GCC, away from thermal desalination and towards the use of reverse osmosis and other electricity-driven membrane technologies for clean water production. Masdar Renewable Energy Desalination Programme pilot studies and related collaborative research projects clearly pave the way for the UAE to lead this trend in both the near and long-term. ■

# UAE WATER AID BOLSTERS THE UAE'S GLOBAL POSITION IN HUMANITARIAN AID



By Mohammed  
Abdulkareem Al Shamsi



**The UAE has established its global position in humanitarian initiatives and humanitarian aid, and its leading role in promoting human solidarity. It has an effective role in the international efforts to combat humanitarian challenges. The UAE has a strong presence in the areas of humanitarian and emergency and long-term aid in all parts of the world.**

H.H. Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, issued a decree establishing the UAE Water Aid Foundation as a non-profit organisation. Based on the decree, the Board of Trustees of the UAE Water Aid Foundation was formed. It is chaired by the MD&CEO of Dubai Electricity and Water Authority (DEWA), one representative each from the Ministry of International Cooperation and Development, UAE Red Crescent Authority, UAE University, Khalifa University of Science, Technology and Research, and two representatives from DEWA.

The Board of Trustees is valid for three years with the possibility of extension. Mohammed Abdulkareem Al Shamsi has been assigned as Acting Executive Director of the UAE Water Aid Foundation.

Since its establishment, UAE Water Aid has become a distinguished organisation that provides humanitarian aid to the needy and distressed around the world.

H.H. Sheikh Mohammed bin Rashid Al Maktoum established the UAE Water Aid Foundation with the noble intention of enhancing the global position of the UAE and supporting countries around the world by coordinating humanitarian efforts and initiatives to improve the living conditions of



**In June 2014, H.H. Sheikh Mohammed bin Rashid Al Maktoum launched the UAE Water Aid 'Suqia' campaign to provide access to fresh drinking water for 5 million people around the world**

poor and disaster-stricken areas, and achieve the sustainable development of all humanity.

It also shares international efforts to provide potable clean water, and fight water-related diseases that threaten lives. Establishing the Foundation is a great support to international efforts to provide clean water to millions of people around the world.

The UAE Water Aid Foundation provides clean water to the needy, conducts studies and research to support producing water using solar power, contributes to financing and supporting water-technology projects to combat drought, and supervises a million-dollar annual award for research that develops new technologies and mechanisms to produce water using solar power.

The UAE Water Aid Foundation works to provide potable water to the needy, the disadvantaged, and those who are in distress around the world. It contributes to finding permanent and sustainable solutions to water scarcity around the world. This is done using the latest technologies, desalinating water using solar power, and providing new and innovative technological solutions for communities that suffer from scarcity and contamination of drinking water.

## ABOUT MOHAMMED ABDULKAREEM AL SHAMSI



He is the Acting Executive Director of UAE Water Aid Foundation (Suqia), DEWA. He has contributed to DEWA's corporate sustainability programme, which resulted in updating DEWA's sustainability strategy map and formulating climate-change strategies through the carbon emission reduction program. Prior to joining DEWA, Al Shamsi worked in a number of leading financial institutions in the UAE.

The Foundation will conduct studies and research to solve water scarcity, particularly using solar power. This achieves its objectives and supports it in carrying out the tasks entrusted to it. This is done in coordination and partnership with educational, academic, and international organisations.

The UAE Water Aid Foundation has launched a number of campaigns to distribute water to Ramadan tents and mosques in collaboration with associations and charities in the UAE, in addition to relief assistance to Yemen in cooperation with the Ministry of Development and International Cooperation. The Foundation is also cooperating with DEWA in the field of research and development on desalination and purification of water using solar energy. It will also cooperate with the Mohammed bin Rashid Al Maktoum Charity and Humanitarian Establishment for the provision of water in various countries around the world.

In June 2014, H.H. Sheikh Mohammed bin Rashid Al Maktoum launched the UAE Water Aid Suqia campaign, to provide access to fresh drinking water for 5 million people around the world. The campaign gained strong response from society and achieved remarkable success. It surpassed its targets, collecting over AED180 million, enough to provide water to over 7 million people around the world. ■

# THE SUSTAINABLE RESEARCH CONSORTIUM



By  
Alejandro Ríos



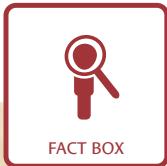
The aquaculture nutrient rich water subsequently flows to irrigate eight *Salicornia* fields, potentially eliminating the need for additional fertilizers

The Sustainable Bioenergy Research Consortium's (SBRC) research focuses on salt-tolerant and arid-land biomass, releasing and capturing bioenergy, synthesising bioenergy, supporting technology and sustainability.





On June 11<sup>th</sup>, 2015, the SBRC broke ground at Masdar City on its two-hectare pilot facility for its flagship project, the Integrated Seawater Energy and Agriculture System



The Sustainable Bioenergy Research Consortium (SBRC) was founded in 2011 by Masdar Institute of Science and Technology, Etihad Airways, The Boeing Company, and Honeywell UOP. Since then, Safran, GE, and the Abu Dhabi Oil Refining Company (TAKREER) have joined the consortium. The SBRC was created with a vision to be the leading research centre for the development of terrestrial, salt-tolerant biomass that can be sustainably converted into bioenergy. Accordingly, the SBRC takes a unique approach that challenges traditional biofuel production mechanisms, and sets the path for the commercialisation of truly sustainable alternative biofuel that does not compete with fresh-water resources or the arable land needed for food.



Since its inception, the SBRC has funded research projects in these areas, investigating issues such as seawater farming, screening and characterising oilseeds from halophytes, energy recovery through anaerobic digestion, bioenergy production from Salicornia and screening of mangroves in the UAE.

The need for solutions that reduce the dependency on finite fossil-fuel resources and address the growing concerns of climate change is imperative. Furthermore, there is a growing demand on the limited resources of food, water and energy and successful sustainable development strategies should be conscious of the close interactions between these systems. On June 11, 2015, the SBRC broke ground at Masdar City on a two-hectare pilot facility for its flagship project, the Integrated Seawater Energy and Agriculture System (i-SEAS), designed to take into consideration biofuel production within the food-water-energy nexus. The pilot facility will be utilised to research the optimal operating conditions of a farm of this nature and to understand the boundaries of the system that will allow for a larger commercial-scale implementation.

The i-SEAS produces food and bioenergy through aquaculture, halophyte agriculture and seawater agroforestry, using non-arable desert land. This system is not only beneficial in the UAE, but is applicable in many regions of the world sharing similar characteristics.

The two-hectare pilot facility – expected to be operational by the end of 2015 – has six aquaculture ponds that are supplied by saltwater where shrimp and fish are cultivated. The aquaculture nutrient-rich water subsequently flows on to irrigate eight Salicornia fields, potentially eliminating the need for additional fertilizers. Salicornia is harvested for its oilseeds and biomass to produce biofuels and the by-products can be used for fish feed and other high-value chemicals and biomaterials. From the Salicornia fields, the water moves on to four mangrove swamps that, with their carbon sequestration abilities, act as an effective greenhouse-gas sink and as a final filtering frontier for the water, which is afterwards recycled and pumped back to the aquaculture ponds.

With this integrated system, the SBRC hopes to lead the UAE on to be a pioneer in the bioenergy field and serve as an international research hub for integrated water,

energy and food systems. In addition, commercialising the system will open the door for economic opportunities and contribute to energy and food security within the region. ■

## ABOUT ALEJANDRO RÍOS



He is the Director of the Sustainable Bioenergy Research Consortium (SBRC). He is a Professor of Practice at the Masdar Institute of Science and Technology (MI). Prior to this, he was Director of ASA Fuel Services for 11 years, overseeing the operation and management of a network of 60 fuel farms and their 2,000+ apron into-plane operations.

# WATER SECURITY THROUGH ENVIRONMENTAL REMOTE SENSING

MONITORING THREATS  
TO WATER SECURITY  
FROM SPACE





ARTICLE

By  
**Dr. Marouane Temimi**

**Desalination is the main source of drinking water in the UAE. Major desalination plants were built in coastal and inland locations in the UAE to face the growing water demand in the country. The investment in desalination plants has been supported by the development of a great infrastructure for water distribution, storage and supply.**

**Furthermore, a substantial investment has been made in water-reuse strategies through major projects like the Strategic Tunnel Enhancement Programme (STEP) in Abu Dhabi.**

the Arabian Gulf also faces a high risk of oil spills from tankers, offshore platforms, or submerged pipelines. When leaks occur, desalination and fishing are (...) impacted

The efficiency of such great water management infrastructure to achieve water security in the UAE depends on a) the availability of clean and abundant water resources and b) access to cost-effective energy sources for efficient water production. With respect to the latter, in the UAE the focus was recently placed on the development of solar-desalination technology, a cutting-edge approach to overcome the increasing energy demand worldwide. Regarding the former, there are two different aspects that should be analysed: the quantity of water to be desalinated and its quality. Since most of the major desalination plants are coastal, the water quantity aspect has never been the main issue in the UAE, except in remote inland areas that rely on local desalination and groundwater pumping, where the depletion of the water table is particularly significant, which could present a high risk to a non-renewable and valuable water resource.

The main challenge in the UAE is to maintain acceptable coastal water quality around the intakes of the desalination plants. The deterioration of seawater quality impacts negatively on water-treatment processes, reducing efficiency and generating additional costs. The growing coastal development activities, oil and gas and maritime traffic, and changing climate conditions are factors, amongst other, that may make meeting the coastal water-quality requirements challenging and could undermine water security in the country. In 2008/2009, a major red-tide event significantly impacted the region (Figure 1) and disturbed water desalination processes, which led to the shutdown of a number of plants. In addition to the red-tide threat, the Arabian Gulf also faces a high risk of oil spills from tankers, offshore platforms or submerged pipelines. When leaks occur, desalination and fishing are again impacted, leading to lost revenue and productivity. It is crucial to develop the necessary capabilities to monitor and forecast such threats to water security. ◀



Figure 1: A major red-tide event in the region observed on November 22, 2008 (European Space Agency)



**The main challenge in the UAE is to maintain acceptable coastal water quality around the intakes of the desalination plants**

Local agencies have invested in in-situ-based monitoring systems of water resources to anticipate all sorts of threats to water resources, whether related to sea-water quality or groundwater levels. One example is the Abu Dhabi Ocean Observing System developed by Abu Dhabi municipality which includes a set of buoys deployed along the Abu Dhabi shoreline to automatically monitor water-quality conditions. Here, satellite imagery can be used to complement the existing monitoring networks and provide water-resource managers with a synoptic view of potential threats that may undermine water security in the country.

Remote sensing and satellite imagery have been widely used in the monitoring of seawater quality conditions. A number of satellite sensors have been launched by NASA, NOAA, and the European Space Agency (ESA) for use in the monitoring of seawater quality. However, it has been necessary to process the raw data from these sensors and adapt satellite-based water-quality monitoring systems to the specific conditions of the UAE and the existing ocean colour satellite products developed by European or U.S. space agencies should be adapted to the dusty environment in the Gulf region. It is particularly important to account for dust and aerosols in the atmosphere and their impact on the quality of satellite images.

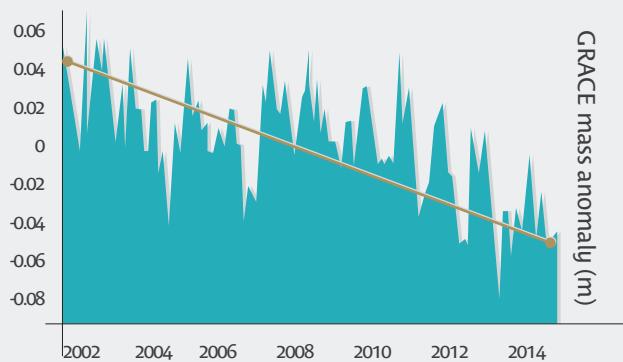


He is an Associate Professor at the Masdar Institute of Science and Technology. He is leading Masdar's environmental remote sensing and modelling research team (<http://earth.masdar.ac.ae/>), which is focusing on the monitoring of environmental processes in the UAE and the region. He worked at the NOAA-CREST Institute at the City University of New York and led/co-led several research projects funded by the National Aeronautics and Space Administration (NASA) and the National Oceanic and Atmospheric Administration (NOAA).

## ABOUT DR. MAROUANE TEMIMI

Moreover, in an effort to monitor available water resources inland local agencies have invested in ground-based monitoring systems of groundwater storage. The Abu Dhabi Environment Agency (EAD), for instance, is developing a national groundwater monitoring programme to detect excessive pumping and significant depletions. It is possible to complement such monitoring systems with information derived from space. Specifically, sensors like GRACE have been useful worldwide in monitoring changes in groundwater. Preliminary analysis of observations from GRACE over Al Ain for instance, has shown a sustained decrease in groundwater storage since 2002 (Figure 2). This example shows the usefulness of such sensors in monitoring groundwater depletion and anticipating excessive use of groundwater storage in a way that may threaten water security.

**Figure 2.** Groundwater monitoring in Al Ain since 2002 sensed by GRACE



One should bear in mind that water security can only be achieved through an integrated strategy that includes investing in necessary infrastructure for optimal water management (i.e. storage, distribution, and supply) and developing operational monitoring programme to monitor potential threats that may impact the scarce water resources in an arid climate like in the UAE. In this regard, we have demonstrated the usefulness of satellite remote sensing and showed how it could complement the existing in-situ monitoring programmes and provide managers with necessary tools to achieve water security in the UAE. ■

# EMIRATES GBC ENERGY EFFICIENCY PROGRAMME (EEP)

THE ONE-STOP SHOP  
FOR ENERGY EFFICIENCY  
PRODUCTS AND SERVICES



By  
Tara Tariq

According to a 2014 UNEP Investor Briefing report, investments in building retrofits have proven to bring in better-than-expected returns for commercial real-estate market investors. Retrofits not only generate savings through energy and water-use reductions, but also improve the value of buildings, with more enhanced procedural maintenance, operational efficiency, occupant comfort and greater longevity as a direct consequence.





FACT BOX

The EEP is free to EmiratesGBC corporate members, which comprise over 150 companies and organisations.

Energy efficiency has enjoyed a relatively stable market niche in the UAE, mainly as an offshoot to the thriving and more established energy-efficiency market of Europe and North America. However, recent policy direction through the Dubai Integrated Energy Strategy (DIES 2030) and demand-side management goals mandated by the Dubai Supreme Council of Energy (DSCE), for instance, have leveraged this market strongly enough to influence the typical business-as-usual model. As of 2011, the Government of Dubai is expecting to see a 30% increase in energy efficiency in 30,000 buildings by the stated deadline year of 2030. A policy response addressing an inefficient market sector – such as poor energy efficiency – is often made to catalyse change and inspire a shift in demand.

The new demand from relevant stakeholders has mainly come in the form of better communication and market accessibility for more streamlined retrofit projects. As the energy-efficiency market has been growing in recent years, it is also manifesting as a fragmented entity. Many industry experts and clients are unaware of the existence of reputable energy-service companies (ESCOs) beyond the few accredited by the Dubai Regulatory and Supervisory Bureau. Emerging innovative and sustainable products receive little publicity due to high advertising costs and

stakeholders find scarcity in choice when identifying the right partners to work with in a high-profile and reduced-risk energy-efficiency project.

The Emirates Green Building Council's Energy Efficiency Programme (EEP) was initiated in 2013 as a response to the call from the industry for a database of energy-efficiency equipment manufacturers, vendors, contractors, consultants and facility managers. By 2014, the programme had received a strong response which prompted the need to increase capacity and availability. In December 2014, the programme was launched for the UAE sustainable-construction market at large.

The EEP hosts an online platform which acts as a nexus for industry experts who actively participate in energy-efficiency projects. The EEP platform provides instant access to Emirates Green Building Council corporate members who have listed their products, services and expertise in the EEP database. While access statistics are not currently being tracked, the platform ensures that companies or clients seeking specific licensed professionals or needing information regarding sustainable products in the UAE market can quickly generate multiple responses through a fairly simple search platform.



FACT BOX

Take a look at the UNEP FI Investor Briefing (February, 2014), United Nations Environmental Program Finance Initiative. Available from: <http://bit.ly/1eQpxQ1>



**Many industry experts and clients are unaware of the existence of reputable energy services companies (ESCOs) beyond the few accredited by the Dubai Regulatory and Supervisory Bureau**

Benefits to participating in the EEP include priority market requests with subsequent participation in mega projects; access to competitive prices; and the more obvious benefit of increased market exposure in the building retrofit industry. The EEP programme also provides a platform for capacity building through seminars and training in energy efficiency. These events also facilitate collaboration between organisations in the building and construction sector. ■

### ABOUT TARA TARIQ



She is a Technical Officer at the Emirates Green Building Council. In addition to serving as Lead Editor for the Technical Guidelines, she is also the Lead for the EmiratesGBC's Energy Efficiency Programme.



**The EEP platform provides instant access to Emirates Green Building Council corporate members who have listed their products, services, and expertise**

# ACKNOWLEDGEMENTS

This report was created under the guidance of:



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# ACKNOWLEDGEMENTS

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# WE THANK OUR TITLE SPONSOR AND ALL OTHER SPONSORS FOR THEIR CONTINUOUS SUPPORT

## DUBAI ELECTRICITY AND WATER AUTHORITY A CONTINUOUS SUCCESS STORY



Dubai Electricity and Water Authority (DEWA) was formed on 1 January, 1992, following a decree issued by the late Sheikh Maktoum bin Rashid Al Maktoum to merge Dubai Electricity Company and Dubai Water Department, which had been operating independently until then.

Both these organisations were established by the late Sheikh Rashid bin Saeed Al Maktoum in 1959 to provide Dubai's citizens and residents with continuous and reliable supplies of electricity and water.

As of 30 June, 2015, this has grown to 692,255 electricity and 614,294 water customers at DEWA. Based on its considerable achievements, it is one of the best utilities in the world.

DEWA's achievements include the Mohammed bin Rashid Al Maktoum Solar Park, which it is currently expanding. It is one of the largest strategic renewable energy projects in the world based on the independent power producer (IPP) model, with a planned total capacity of 1,000MW by 2019 and 3,000MW by 2030. It was launched in 2012 and the 13MW first phase became operational on 22 October 2013. The IPP-based 200MW second phase will be operational by 2017. The Solar Park includes a Research and Development Centre (R&D),

a solar-testing facility, an innovation centre, a university, and a training centre. DEWA has increased the share of renewable energy in Dubai's energy mix to 7% by 2020 and 15% by 2030.

DEWA has awarded a contract to expand its M-Station power production and desalination plant. The expansion project will add 700MW to the current capacity of the station to eventually produce 2,700MW by 2018.

DEWA works continually to enhance its installed capacity, which is currently 9,656MW of electricity and 470 million imperial gallons of desalinated water per day. After completing the expansion, DEWA's installed capacity will be 10,356MW. DEWA has also begun work on the Hassyan Clean-Coal Power Plant based on the IPP model, with an installed capacity of 1,200MW. The first phase is expected to be operational by 2020.

DEWA has started implementing its smart initiatives to make Dubai the smartest city in the world. The first initiative, Shams Dubai, encourages tenants and building owners to install photovoltaic (PV) solar panels to generate electricity. The electricity generated is used within the premises and the surplus is exported to DEWA's grid. This encourages the use of renewable

energy, increases its share in the energy mix, and diversifies energy sources. The second initiative, Smart Applications and Meters, contributes to fast-service connection, fast response, and rationalising energy and water use. The third initiative, Green Charger, builds the infrastructure for 100 electric vehicle charging stations. DEWA has already established 16 Green Charger stations and will install 84 more stations this year.

In terms of benchmarking, DEWA has achieved outstanding results that excel over even the private sector. DEWA has surpassed leading European and American companies by reducing losses in power transmission and distribution networks to 3.26%, compared to 6-7% in Europe and the USA. Water network losses decreased to 9.1%, compared to 15% in North America, achieving global results in reducing water losses. DEWA's results are among the best internationally for customer minutes lost per year. It reached 4.9 minutes, compared to 15 minutes recorded by leading utilities in the European Union. The UAE, represented by DEWA, has been ranked fourth globally and first in the Middle East and North Africa for the second consecutive year for getting electricity as per the World Bank's Doing Business 2015 report.

# COMPANY PROFILES



## ABU DHABI NATIONAL OIL COMPANY (ADNOC)

Abu Dhabi National Oil Company (ADNOC) was established in 1971, to operate in all areas of the oil and gas industry. Since then ADNOC has steadily broadened its activity in upstream and downstream operations establishing an integrated oil and gas industry operating through its various companies in the fields of exploration and production, support services, oil refining and gas processing, chemicals and petrochemicals, maritime transportation and refined products and distribution.

The Supreme Petroleum Council (SPC), chaired by H.H. Sheikh Khalifa Bin Zayed Al Nahyan, President of the UAE and Ruler of Abu Dhabi, formulates and oversees the implementation of Abu Dhabi petroleum policies.

As result of the huge expansion of its business activities, ADNOC today manages and supervises production of more than 2.8 million bpd of crude oil which ranks it among the top ten oil and gas producing companies in the world.

Driven by the huge expansions in its business activities and the large investments in the various fields of the oil, gas and petrochemical industry including transportation, distribution and marketing services ADNOC Group today comprises 17 affiliates and joint venture companies. They include ADCO, ADMA-OPCO, GASCO, ADGAS, ZADCO, TAKREER, NDC, ESNAAD, IRSHAD, FERTIL, BOROUGE, ADNATCO- NGSCO, ADNOC Distribution, ELIXIER, Abu Dhabi Gas Development Company Ltd and Al Dhafra Oil Operations Company Ltd.

Due to the continuous efforts exerted by ADNOC to develop oil and gas industry the UAE now occupies a leading position in the use of the latest technology in the exploration, drilling and production of oil and gas, the proper utilization of hydrocarbon resources in the onshore and offshore fields and the continuous improvement of reservoirs management.

While carrying out all its business activities ADNOC is committed to sustainable development, ensuring a harmonious balance between people's needs and Earth's resources, adhering to the best international practices and supporting all programs and initiatives of environment protection and its track record in HSE sets the standard not only at the regional level but at the international level as well.

In line with the governmental policies aiming at investment in human resources development through the education, training and employment of UAE nationals, ADNOC is giving top priority to national cadres' development. For that end, ADNOC has established a number of academic institutions and launched a wide range of training programs to train and prepare the UAE nationals to carry out their role in the development of the energy sector.

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## EMIRATES NATIONAL OIL COMPANY (ENOC GROUP)



### About ENOC:

ENOC is wholly owned by the Investment Corporation of Dubai, an entity under the Government of Dubai in the United Arab Emirates (UAE).

Over the past 30 years, ENOC Group has evolved from a local oil and gas player to a global operator across various aspects of the energy sector value chain. Now servicing thousands of customers across 58 markets, ENOC is deploying talent and technology to diversify its offerings to achieve sustainable development.

ENOC handles a diverse business portfolio promoting the interests of its stakeholders across upstream, midstream and downstream activities in the energy sector locally and globally.

Its business activities span the exploration and production of oil and gas; refining and processing; marketing and retailing of petroleum products; oil and commodities trading, terminalling and storage; and oil-related shipping activities. By building on their success in international markets and expanding exploration and production portfolio, ENOC aspires to become a leading international integrated oil and gas company.

**ENOC operates through five business segments, namely:**

**Supply, Trading & Processing** – Condensate and gas processing, and oil trading

**Terminals** – Storage for various petroleum and chemical products

**Marketing** – Marketing of aviation fuel, lubricants, LPG and industrial fuels and services

**Retail** – Retailing fuel and nonfuel services

**Exploration and Production** – Dragon Oil adds production and exploration assets operational expertise into ENOC's portfolio. The Group now possesses world class producing assets of over 100,000 barrels of oil per day, along with proven and probable reserves of 660 million barrels in the CIS region

As the energy partner behind Dubai's phenomenal growth, ENOC touches almost every facet of the emirate's development and has put its name firmly on the overseas arena. ENOC supports the Dubai Plan 2021 to establish Dubai as a smart & sustainable city through smart innovations and sustainable development initiatives.

### Leadership:

Chairing ENOC's Board is His Highness Sheikh Hamdan Bin Rashid Al Maktoum, Deputy Ruler of Dubai and the UAE Minister of Finance

ENOC's Vice Chairman is His Excellency Saeed Mohammed Al Tayer

The company is led by Group Chief Executive Officer Saif Al Falasi

### Staff:

ENOC has over 6,000 employees across 31 subsidiaries.

### FEDERAL ELECTRICITY & WATER AUTHORITY (FEWA)

الهيئة الاتحادية للكهرباء والماء  
Federal Electricity & Water Authority



To run its own projects, to be more efficient and self-dependent, and to cope with the demands of the public Federal Electricity & Water Authority (FEWA) was established to be an independent entity that runs to develop and improve the lives of people. Established in 1999, FEWA's main objective is to cater the needs of the Northern parts population. To achieve its main objective FEWA has to create a balance between the cost of production and the distribution price in consideration with unifying the existing variable pricing strategies, study the consumption behaviors and create awareness on efficient usage of electricity and water by consumers. With more than 2500 employees, four main directorates, four core departments and five supporting departments, six main offices and 16 branch offices FEWA; supplies to more than 570,000 customers across four cities.

FEWA seeks through its vision for leadership in providing electricity and water services to improve the standards of living and achieve sustainable growth by 2021. Federal Electricity & Water Authority seeks to achieve; UAE's vision 2021 by ensuring sustainable development while preserving the environment along with achieving a balance between economic and social developments. Improving and providing the best for customers to reach a high level of satisfaction. Continuous developments of green houseplants that will reduce and improve level of efficiency and will work towards achieving sustainability. Seeking to educate and aware the public on different techniques of conserving both water and electricity resources. Finally, ensuring administrative services provided in accordance with standards of quality, efficiency and transparency.

By developing electricity and water facilities infrastructure FEWA will meet its mission by the growing demands of electricity and water in the Emirates under FEWA jurisdiction to enhance sustainable development.

## ROADS & TRANSPORTATION AUTHORITY (RTA)

طبيعة الطرق والمواصلات  
ROADS & TRANSPORT AUTHORITY

RTA

The Roads and Transport (RTA) came into existence in November 2005 post the decree No.48 issued by Late Sheikh Maktoum Bin Rashid Al Maktoum which included the appointment of H.H. Sheikh Mohammed Bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, as the President of the newly formed Roads and Transport Authority (RTA).

His Excellency (H.E) Mattar Al Tayer, is the Director General, Chairman of the Board of Executive Director of the RTA. H.E. Al Tayer heads the Board of directors of the authority that consists of five agencies namely; the Traffic & Roads Agency, Public Transport Agency, Licensing Agency, Rail Agency and Dubai Taxi Corporation in addition to three support sectors which are: Strategy & Corporate Governance,

Corporate Administrative Support Services, and Corporate Technical Support Services.

RTA's Director General who runs all RTA affairs including the implementation of decisions & policies developed by the Board, supervising the business of the executive body, preparing annual budgets, proposing Organization Charts as well as financial & administrative regulations, overseeing the business of RTA-affiliated agencies, and exercising any other powers entrusted to him by the Board or pursuant to any enacted law.

The entity is responsible for planning and providing an integrated transport system in the Emirate of Dubai, and between Dubai and other Emirates of the UAE capable of achieving Dubai's vision & serving the vital interests of the Emirate.

Managing the strategies and needs of the transport sector in Dubai is an important task that the RTA has, and being an independent authority in terms of its administration and management, it is legally authorized to do everything which will help it achieve its vision of 'Safe and Safe Transport for all'.

Since its establishment in 2005, the entity has achieved numerous accolades by constructing and operating key turnkey road and transport projects. These include the 75 kms Dubai Metro which is the longest driverless Metro in the world, the Dubai Tram, increasing safety and reducing pedestrian fatalities, expanding the road networks by 45% with the construction of parallel roads and creek crossings and procuring a modern fleet public buses and revamping marine transit means.



### ABDUL LATIF JAMEEL ENERGY (ALJ - ENERGY)

#### Abdul Latif Jameel Energy and Environmental Services

Abdul Latif Jameel Energy and Environmental Services, an independent entity of Abdul Latif Jameel, was formed in 2012 with the intent to become a leading international power plant developer, an independent power producer, and a premier service provider of operations and maintenance in the renewable energy sector.

In April 2015, Abdul Latif Jameel Energy and Environmental Services acquired a leading global

developer of solar power plants, Fotowatio Renewable Ventures ('FRV'), making the business the largest GCC-based solar PV developer and one of the leading solar PV developers in the world. FRV has extended its technical and project development expertise within the renewable energy space to include wind energy to complement its solar offering.

Abdul Latif Jameel Energy and Environmental Services is based in Dubai, United Arab Emirates, and through its acquisition of FRV has a global footprint that extends beyond the MENAT

region to include operations and solar projects in Asia Pacific, Sub-Saharan Africa, South Africa, and Latin America. The business' current solar PV project pipeline stands at approximately 4.3 GW across 19 countries.

In line with the guiding principle of Abdul Latif Jameel, Abdul Latif Jameel Energy and Environmental Services strives for local job creation and vocational training in the countries where it establishes operations with the intent of building local capacity and a lasting legacy of capable energy sector expertise.



### DOLPHIN ENERGY

The Dolphin Gas Project of Dolphin Energy Limited is a major regional strategic energy initiative. Since July 2007, the company has been producing, processing and supplying substantial quantities of natural gas from offshore Qatar to the United Arab Emirates via its dedicated sub-sea export pipeline.

Production reached the maximum authorized throughput of 2 billion standard cubic feet of gas per day (scf/day) in February 2008 and delivery of natural gas to Oman started in October of the same year.

The overall investment in constructing the entire Dolphin Gas Project – wells, sea lines, processing plant, export pipeline, receiving facilities and the UAE Gas Network – has made it one of the largest energy-related ventures ever undertaken in the Middle East at a cost of US\$5.8 billion.

Dolphin Energy supports the development of substantial long term new industries throughout the region: creating sustainable wealth, economic growth and employment opportunities for citizens far into the future.

Dolphin Energy Limited is owned 51 percent by Mubadala Development Company, on behalf of the Government of Abu Dhabi – and 24.5 percent each by Total of France and Occidental Petroleum of the USA.

Detailed information about Dolphin Energy can be found on [www.dolphinenergy.com](http://www.dolphinenergy.com)

## ESOLAR



eSolar, Inc., founded in 2007 and based in Burbank, California, develops solar collector system (SCS) technologies suitable for concentrated solar thermal power towers. These technologies significantly reduce the cost of delivered thermal energy for power generation and process heat applications.

Since its inception, eSolar has developed multiple generations of SCS that are comprised of heliostats and associated control and calibration systems that focus and concentrate solar heat flux onto a steam or molten

salt receiver. eSolar's SCS is compatible with our signature scalable and modular solar fields as well as large single tower configurations.

eSolar has simultaneously contributed to solutions for the solar receiver system (SRS) working in concert with industry leading receiver suppliers such as B&W, Victory Energy and Aalborg CSP. This has provided us the capability to provide an integrated SCS/SRS system. Prior investments and efforts have led to the commissioning of two pilot plants to date in the US and India

providing invaluable experience in validating our design approach and operation of multiple, modular solar fields. eSolar has been selected as the solar field supplier for the Sundrop Farms project in Port Augusta, Australia. The Sundrop Farms project is a 20 hectare greenhouse where tomatoes are grown with solar power and desalinated water.

In addition to its headquarters in Burbank California, eSolar operates regionally out of Dubai, United Arab Emirates.

## INSINKERATOR



InSinkErator, a business unit of Emerson Electric Co. the inventor and world's largest manufacturer of food waste disposers and steaming hot water taps for home and commercial use.

The company offers diverse portfolio of products include basic disposer units, high performance

line of disposers known as the Evolution Series, instant hot water dispensers and food waste pulper systems—units that can be used both at home or on a more professional food service level. InSinkErator food waste disposers are efficient, economical, environmentally friendly and hygienic way to dispose of food

waste, all models are easy to install and operate.

Over the last 77 years we don't just develop and promote sustainable product solutions; we constantly innovate, educate, and encourage public engagement to realize a sustainable future for humanity.



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See you next year.

You will find our media rates and more information online.  
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**“**The UAE has clearly shown its role as a regional leader when it comes to innovation. It has dared to implement new approaches to energy policy planning and new energy technologies. Our success stories can serve as inspiration to other countries.

**H.E. Suhail Al Mazrouei**  
UAE Minister of Energy

Find out more about the UAE Ministry of Energy and its team, the UAE State of Energy Report 2016, the UAE Greenhouse Gas Inventory and much more on [www.moenr.gov.ae](http://www.moenr.gov.ae).

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ISBN978-9948-18-777-6

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