



2017 Annual Report

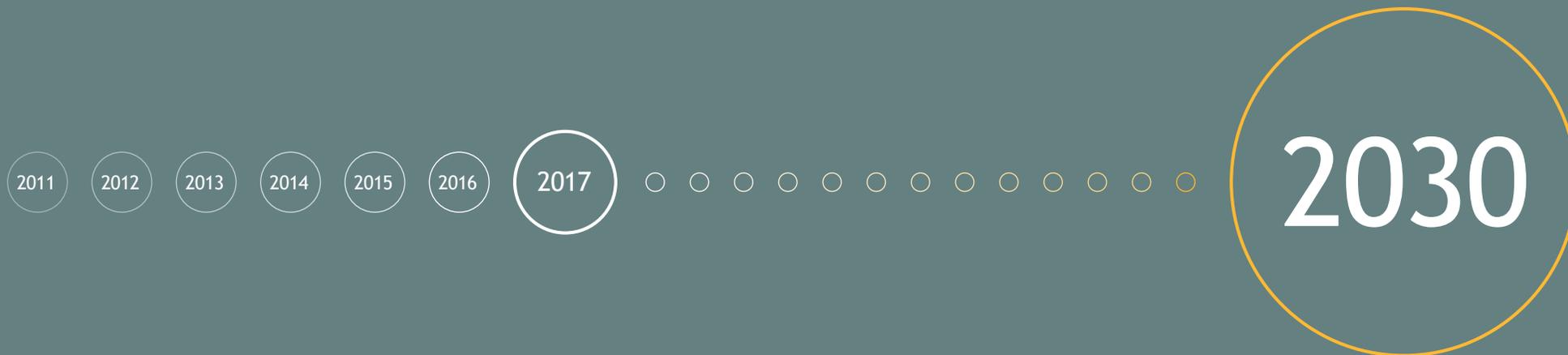
Dubai Demand Side Management Strategy



طاقتي
TAQATI

برنامج دبي لكفاءة الطاقة
DUBAI ENERGY EFFICIENCY PROGRAM

“For an Efficient Future”



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HH Sheikh Mohammed bin Rashid Al Maktoum

Vice President and Prime Minister of
the United Arab Emirates and Ruler of Dubai

“ 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.



**HH Sheikh Hamdan bin Mohammed
bin Rashid Al Maktoum**

Crown Prince of Dubai and Chairman
of the Executive Council

“

History bears witness to our Founding Fathers' foresight and wisdom in the decisions they've made, decisions whose benefits we continue to enjoy today. Looking to the future is our leadership's permanent policy; they spare no effort in building a bright tomorrow for the nation's coming generations.



HH Sheikh Ahmed bin Saeed Al Maktoum

Chairman of the Dubai Supreme Council of Energy

“ There has been much progress to date in the move towards a green economy, where economic growth and environmental responsibility are given equal importance in the development of a sustainable future. Indeed, the green economy is an engine of growth, providing opportunities for both the public and private sector.



Launch of the Demand Side Management Annual Report by
His Highness Sheikh Ahmed bin Saeed Al Maktoum,
Chairman of the Dubai Supreme Council of Energy (DSCE);
His Excellency Saeed Mohammed Al Tayer, Vice Chairman of DSCE;
His Excellency Ahmad Buti Al Muhairbi, Secretary General of DSCE;
and Members of the Board



MESSAGE FROM: VICE CHAIRMAN OF DUBAI SUPREME COUNCIL OF ENERGY

Dear valued stakeholders,

I am pleased to present the fourth annual report on the Demand Side Management Strategy (DSM) of Dubai, which highlights the significant efforts taken by DSM programme owners and stakeholders in 2017, in collaboration with the Supreme Council of Energy and TAQATI, delivering savings that surpassed the set targets.

In Dubai, we work to achieve the vision of HH Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, to instil sustainability, which is the basis for our transition towards a green economy. We have adopted a holistic approach for the energy sector, covering issues such as energy security, energy efficiency, energy sustainability and its rational use. This will transform Dubai into an international hub for clean energy and green economy, becoming the city with the lowest carbon footprint in the world. Energy demand side management is one of the main challenges of the 21st century for the world community, and the high global demand for energy and water highlights the urgent need to rationalise consumption and enhance demand management to ensure environmental sustainability and reduce waste of resources.

The Demand Side Management Strategy aims to reduce electricity and water demand by 30% by 2030. It focuses on reducing energy demand and adopting best international techniques and practices to conserve the resources. We are collaborating with key stakeholders in the public and private sectors to achieve our ambitious target of 30% energy savings by 2030.

In 2017, we managed to save a total of 3.3TWh of electricity and 4.9 billion imperial gallons of water. These savings correspond to a reduction of 9% and 11% per capita in electricity and water consumption respectively since the commencement of the DSM strategy in 2010. This corresponds to approximately AED1.1 billion of avoided capital investments for new generation capacity and AED3.1 billion of avoided operational costs. In the coming years, we look forward to achieving more results through our initiatives and programmes to build capacity and sustain the growth of the energy efficiency market in Dubai.

I thank our valued stakeholders for their contributions, and look forward to further collaborating for a brighter future, for generations to come.

HE Saeed Mohammed Al Tayer

Vice Chairman of the Dubai Supreme Council of Energy



MESSAGE FROM: SECRETARY GENERAL OF DUBAI SUPREME COUNCIL OF ENERGY

The Demand Side Management (DSM) Strategy, the Dubai Supreme Council of Energy (DSCE) aims to make Dubai a role model in energy efficiency by implementing cost effective electricity and water demand saving programmes, and developing a green service market. With robust results from the DSM Strategy so far, we are pleased to report that Dubai is continuing to move in the right direction.

This could not have happened without the dedication and collaboration of a large number of government entities who are governed by visionary leaders. They are supported by a dedicated DSM programme management office, TAQATI, which focuses on supporting and helping them to achieve their targets and set up the enablers, such as awareness and capacity building, for a green service market.

The results for 2017 show a strong commitment to this strategy, with sustained improvements from all eight DSM programmes. The savings continue to be above the set targets, with 7.6% savings in electricity and 4.3% savings in water compared to the business as usual scenario.

Looking at the near future, with progressively higher saving targets, we understand that greater commitment and increased efforts are critical to sustain our success. General awareness has to improve, capacity building and specialised education will have to become more prevalent. We also need innovative financing mechanisms to meet the next stage of our goals.

We look forward to continuing the upward journey and are fully confident in our stakeholders' commitment and ability to scale up their activities. As the custodian of the DSM Strategy, the Dubai Supreme Council of Energy (DSCE) will continue to provide institutional guidance and endorsement, while TAQATI will extend dedicated implementation support.

HE Ahmad Buti Al Muhairbi

Secretary General of the Dubai Supreme Council of Energy

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1

EXECUTIVE SUMMARY



This report, in its fourth year of publication, presents the progress and performance of the Dubai Demand Side Management (DSM) Strategy for 2017. The strategy comprises eight main programmes addressing different aspects of demand for electricity and water in Dubai.

Each programme has a responsible government entity for execution, a programme owner, and is supported by a dedicated programme management office, TAQATI, under the supervision of the Dubai Supreme Council of Energy (DSCE). The end goal of the strategy is to deliver 30% by 2030 of sustainable yearly savings in electricity and water compared to the business as usual consumption.

By the end of 2017, the DSM Strategy implementation resulted in 3.3 TWh annual electricity savings and 4.9 BIG annual water savings, corresponding to 7.6% and 4.3% of the baseline consumption, respectively. This marks a surplus versus the 2017 target savings, which are 2.9 TWh for electricity and 4.8 BIG for water, and a substantial growth from 2016 actual savings of +18% for electricity and +31% for water, as most programmes are rapidly expanding. The avoided cost in generation capacity and natural gas consumption is estimated to be approximately AED 4.2 billion since the strategy initiation in 2011.

These important achievements come as a combination of efforts from all programme owners, who are committed to yearly targets and a roadmap to 2030, and for whom the DSM Strategy is increasingly becoming part of their core activities.

AMONG THE KEY ACHIEVEMENTS OF 2017:

- The Dubai Green Building Regulations and Specifications (DGBRS) 2010 have reached full compliance in new buildings permitted by Dubai Municipality.
- Substantial retrofit projects in Jebel Ali Free Zone Authority (JAFZA) and Mohammed Bin Rashid Housing Establishment have been completed and new major projects were initiated.
- Efficiency standards for indoor water fixtures have been enforced by Emirates Authority For Standardization and Metrology (ESMA).

- Shams Dubai Programme has experienced considerable growth thanks to measures taken and rapidly improving capabilities.
- The first phase of the Energy Intensity Mapping is completed with the upload of data for 5,000 buildings in Dubai.
- As part of the Green Public Procurement for Energy and Water Efficiency initiative, the indoor lighting criteria has been successfully tested by DSCE member entities and criteria for the other most energy consuming products have been developed.
- The DSM Integrated Awareness Strategy 2022 was developed, and collaborative awareness initiatives were initiated amongst the programme owners.
- The Integrated Outreach and Awareness Committee was launched to coordinate and streamline DSM awareness efforts and the Home Energy Advice Programme pilot was successfully carried out.

The coming years will see a steep increase in saving targets, and hence several programmes are expected to step up their measures. This would involve, for example, updates to the green building regulations and expansion of their application to free zones, upgrades to the efficiency standards of some appliances, scale up of retrofit activities, increased penetration of district cooling, broader implementation of LED or other efficient technology in street lights, and adoption of solar photovoltaic (PV) for rooftops. Specific work will be dedicated to unlock synergies and enable growth of some DSM programmes relying on multiple stakeholders for an effective implementation, such as District Cooling and Water Reuse and Efficient Irrigation. In parallel, efforts will be deployed to build financing enablers and enhance the existing systems and processes for monitoring and evaluating DSM energy savings.

In the current economy, the DSM Strategy plays an important part in the sustainable growth of Dubai. It is generating real savings, improving awareness, building DSM capabilities in Dubai, and developing the energy efficiency market. The ongoing and anticipated support received from the leaders and institutions means the DSM Strategy will achieve its long term goals.

2

OBJECTIVES AND SCOPE OF THIS REPORT



The objective of this report is to present the progress and performance of the Dubai Demand Side Management (DSM) Strategy: a strategy spearheaded by the Dubai Supreme Council of Energy (DSCE), implemented by key government entities in Dubai, and supported by TAQATI.

The report comprises a description of the DSM Strategy, a presentation of the achievements in 2017, and an outline of the priorities to be pursued in the next three years.

It outlines achievements in electricity and water savings attained from implementing DSM programmes in comparison with preset target savings, along with other performance indicators, such as changes in per capita consumption and results of a Total Resource Cost Test.

Data presented in this document are the result of a reporting system that DSCE maintains through TAQATI in collaboration with the DSM programme owners: Dubai Electricity and Water Authority, Dubai Municipality, Roads and Transport Authority, the Regulatory and Supervisory Bureau for Electricity and Water in Dubai, Etihad Energy Services and Emirates Authority for Standardization and Metrology.



3

CONTEXT AND OVERVIEW OF THE DSM STRATEGY



3.1 POLICY CONTEXT

The Demand Side Management (DSM) Strategy is part of the Dubai Integrated Energy Strategy (DIES) 2030, whose main goals are to secure Dubai’s uninterrupted energy supply and moderate its growing electricity and water demand (see exhibit 1).

Optimising energy demand is a strategic priority for Dubai given its dependency on energy imports and economic growth. It moderates the need for next generation capacity and frees up resources for strategic investments.

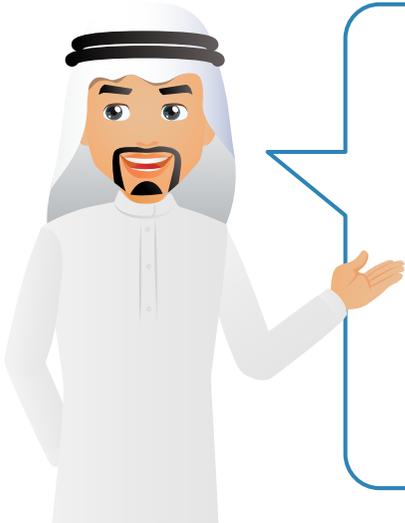
At the same time, DSM supports the growth of a green economy and hence the creation of green jobs, it aligns with smart city objectives through the employment of smart technology, and contributes to a safer environment by reducing carbon emissions.

The convergence of such important goals in the DSM Strategy has integrated well with the agendas of Dubai and the UAE (see exhibit 2).

CONTEXT AND OVERVIEW OF THE DSM STRATEGY



Exhibit 1: Demand Side Management as part of the Dubai Integrated Energy Strategy 2030



THE DSM STRATEGY IS PART OF DIES 2030 AND IS ALIGNED WITH UAE AND DUBAI POLICY AGENDAS



Exhibit 2: Dubai Integrated Energy Strategy and Demand Side Management in the context of the policy agendas of the emirate and the nation



3.2 DEMAND SIDE MANAGEMENT STRATEGY, ROADMAP AND TARGETS

DSM Strategy

The DSM Strategy comprises eight programmes, designed to address different aspects of electricity and water consumption sources in Dubai. Programmes are supported by a series of implementation mechanisms, mainly capability building, awareness improvement, measurement and verification, policies and regulations, and financing (see exhibit 3 and 4).

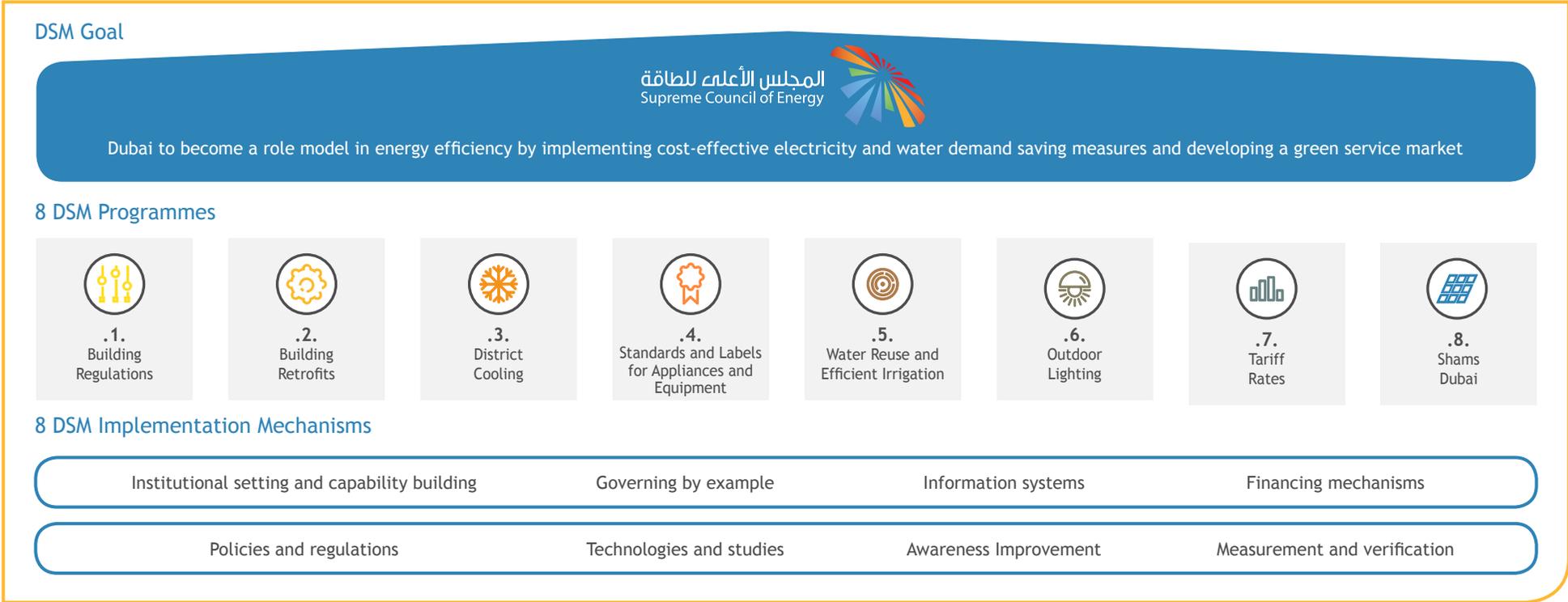


Exhibit 3: Architecture of the Demand Side Management Strategy with its eight programmes and eight implementation mechanisms

CONTEXT AND OVERVIEW OF THE DSM STRATEGY



Programme	Scope
1 Building Regulations	Implement Dubai Municipality's (DM) existing green building regulations in new buildings and update the regulations to double electricity and water savings.
2 Building Retrofits	Retrofit the existing building stock in Dubai with electricity and water efficiency measures, in the aim of reducing the energy intensity of up to 30,000 buildings in Dubai by 2030. Start from government buildings, followed by commercial and residential buildings.
3 District Cooling	Increase the penetration of efficient district cooling (DC) to 40% of the total cooling capacity of Dubai in 2030 by regulating the DC market.
4 Standards and Labels for Appliances and Equipment	Develop, implement and regularly update electricity and water efficiency standards and comparative labels for high consuming appliances and equipment used in the UAE. Promote the adoption of higher efficiency products.
5 Water Reuse and Efficient Irrigation	Irrigate all public areas with treated sewage effluent (TSE), implement efficiency measures in Dubai's green areas and use excess capacity of TSE for other uses (e.g., private irrigation and DC).
6 Outdoor Lighting	Adopt high-efficiency technology for outdoor lighting in roads and other public areas of Dubai, both in new installations and retrofits of the existing assets. Implement efficiency measures, such as dimming and partial switch-off in residential areas.
7 Tariff Rates	Adjust electricity and water tariff rates in Dubai to be cost-effective, ensure economic efficiency, and align ratepayer with DSM objectives.
8 Shams Dubai	Encourage building and household owners in Dubai to install solar photovoltaic (PV) systems on their rooftop and connect them to Dubai Electricity and Water (DEWA) grid; and as a result, reduce their electricity bills and total demand on the grid.

Exhibit 4: Scope of the Demand Side Management programmes

DID YOU KNOW?

A key mechanism broadly adopted is the principle of **governing by example**, whereby the government takes the first steps in a new initiative and builds success cases to develop a market that the private sector can leverage in subsequent phases. The principle was tested in the implementation of the Dubai Green Building Regulations and Specifications 2010, which were made mandatory for government buildings only in initial years. The principle has also been applied to other programmes, so far the Building Retrofits Programme and the Standards and Labels Programme through the Green Public Procurement for Energy and Water Efficiency initiative.



DSM Targets

The government of Dubai is committed to achieving ambitious electricity and water savings through the implementation of the eight DSM programmes. By 2030, Dubai targets overall electricity savings of about 19 TWh and water savings of 47 BIG, which correspond to 30% savings versus business as usual (see exhibit 5).

THE DSM STRATEGY TARGETS
30% SAVINGS BY 2030
VS. BUSINESS AS USUAL CONSUMPTION



CONTEXT AND OVERVIEW OF THE DSM STRATEGY

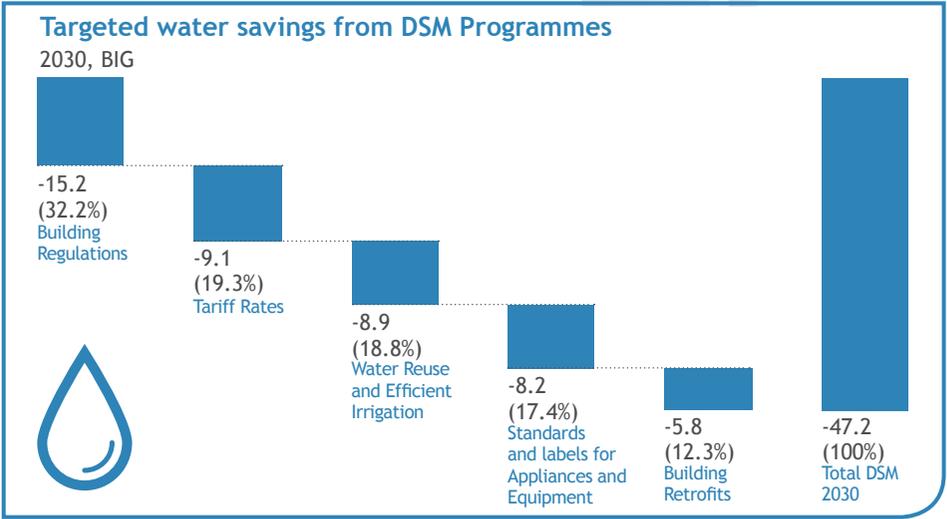
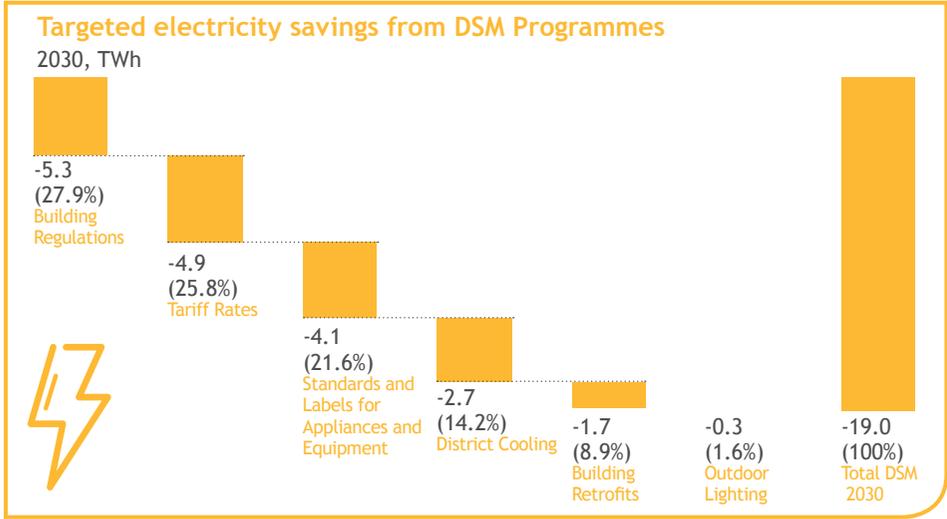


Exhibit 5: Demand Side Management 2030 saving targets for electricity and water



DSM Roadmap

A strategic roadmap to achieve the 2030 targets was defined and agreed upon by programme owners and DSCE in the DSM Policy document. The preparatory and activation phases of DSM Strategy implementation were completed with the institutional set-up, the definition of goals and roadmaps, and the activation of programmes (see exhibit 6).

As per the agreed roadmap, in the current phase of DSM Strategy implementation, the ramp-up phase, initial activities should rapidly scale-up, emerging capabilities should consolidate, pilot projects should progress towards larger scale roll-out, and programmes should start delivering substantial savings. In this phase, significant contribution from the government is still expected in pioneering implementation and showcasing success stories. As for the private

sector, its increasing participation is anticipated in the coming years. At the end of the ramp-up phase in 2020, savings are targeted to be 8-10% versus business as usual.

In the last ten years of strategy implementation, between 2020 and 2030, a second wave of DSM measures is planned to scale up energy savings from key DSM programmes and penetration is expected to reach a large portion of government and private sectors.

While targets are fixed, a plan of such duration needs to be subject to a degree of flexibility. As new technologies and best practises around the world continue to emerge and Dubai growth patterns evolve, the DSM Strategy will undergo periodic revisions to fit a changing context.

CONTEXT AND OVERVIEW OF THE DSM STRATEGY

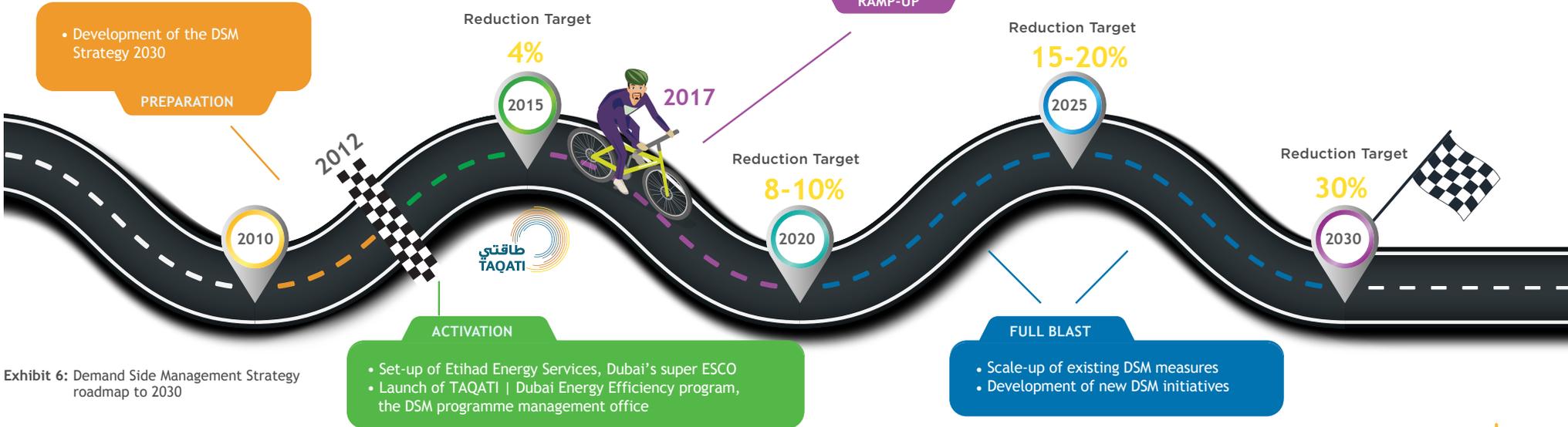


Exhibit 6: Demand Side Management Strategy roadmap to 2030



3.3 INSTITUTIONAL FRAMEWORK

Implementation of the DSM Strategy is supervised by the DSCE. The DSCE, which governs broad aspects of energy supply and demand in Dubai, is chaired by His Highness Sheikh Ahmed bin Saeed Al Maktoum and comprises top executives from key Dubai Government institutions: Dubai Electricity and Water Authority (DEWA), Roads and Transport Authority (RTA), Dubai Municipality (DM), Emirates Global Aluminium (EGA), Emirates National Oil Company (ENOC), Dubai Supply Authority (DUSUP), Dubai Petroleum Affairs, Dubai Petroleum Establishment (DPE), Dubai Nuclear Energy Committee.

Each DSM programme has its respective programme owner, a government entity responsible for its execution. The entity, which is selected on the basis of its mandate and strength, is focused on delivering results and addressing challenges specific to the programme it owns (see exhibit 7).

A DSM Executive Committee, chaired by DSCE and comprising senior representatives from all programme owner entities, has been established to ensure coordination and support to the DSM Strategy. On the date of publication of this report, members of the DSM Executive Committee are:



HE Ahmad Al Muhairbi
Secretary General, DSCE
Chairman

Yousef Jebрил
Executive Vice President,
Power and Water planning, DEWA
Vice Chairman

Faisal Rashid
DSM Director, DSCE
Secretary

Ali Al Jassim
CEO, Etihad Energy Services
Member

Aref Abou Zahr
Executive Director, TAQATI
Member

Fahed Al Awadhi
Director of Drainage and
Irrigation Department, DM
Member

Fida Alhammadi
Head Of Researches and
Building systems, DM
Member

Graeme Sims
Executive Director,
Regulatory Supervisory Bureau
for Electricity and Water in Dubai
Member

Mohammed Al Shamsi
Sr. Manager, Climate Change
and Sustainability, DEWA
Member

Nabil Battal
Director, Global Safety and
Environment, DP World
Member (on behalf of Dubai Free Zones Council)

Mustafa Al Yousuf
Board Member, Regulatory Supervisory
Bureau for Electricity and Water in Dubai
Member

Bassel Saad
Director of Roads Maintenance, RTA
Member

Samer Khoudeir
Chief Sales and Marketing Officer, Empower
Member

Shamma Al Rahmah
Manager, Business Planning and
Performance Management, ENOC
Member

Taher Diab
Sr. Director, Strategy and Planning, DSCE
Member

Supervision

DSCE Board

المجلس الأعلى للطاقة
Supreme Council of Energy



Direction

DSM Executive Committee



هيئة الطرق والنقل
ROADS & TRANSPORT AUTHORITY



Support

DSCE DSM Directorate

المجلس الأعلى للطاقة
Supreme Council of Energy



Management

DSM Programme Manager



Implementation

DSM Programme Implementation Teams

DSM Programmes

Programme Owners

1	Building Regulations	DM	
2	Building Retrofits	Etihad ES & RSB	
3	District Cooling (DC)	Etihad ES & RSB	
4	Standards and Labels for Appliances and Equipment	ESMA	

DSM Programmes

Programme Owners

5	Water Reuse and Efficient Irrigation	DM	
6	Outdoor Lighting	RTA & DM	
7	Tariff Rates	DEWA	
8	Shams Dubai	DEWA & Etihad ES	

Exhibit 7: Governance structure of the Demand Side Management Strategy



AREF ABOU ZAHR

Executive Director, TAQATI

TAQATI | DUBAI ENERGY EFFICIENCY PROGRAMME

It is TAQATI's second year of operation since its launch in May 2016 as a dedicated programme management office to support the implementation of the DSM Strategy, as mandated by the Dubai Supreme Council of Energy.

2017 has been a year of great accomplishments for DSM Strategy stakeholders. TAQATI continues to provide advisory support to the programme owners in developing their DSM-related operational plans, and identifying associated risks and mitigation measures to meet annual targets. TAQATI has developed and started implementing the DSM Integrated Awareness Strategy (IAS2022) working closely with DSM programme owners and their Marketing and Corporate Communication teams. In addition, TAQATI has prepared to launch the Energy Efficiency Training Programme in collaboration with renowned international training institutions.

Looking ahead, TAQATI will further streamline active support of DSM programme owners in operational planning and forecasting to achieve DSM 2030 targets through even closer collaboration, analytical thinking and consistent dedication in the aim of maintaining the same performance levels of the past years.

TAQATI's vision is to be the driving mentor of electricity and water efficiency strategies to make Dubai one of the most sustainable cities in the world. The office's mission is to identify and lead the implementation of result-driven electricity and water efficiency strategies, to achieve Dubai's sustainability goals.



Exhibit 8: TAQATI functions



4

DSM STRATEGY ACHIEVEMENTS



4.1 OVERVIEW OF THE MAIN ACHIEVEMENTS TO DATE

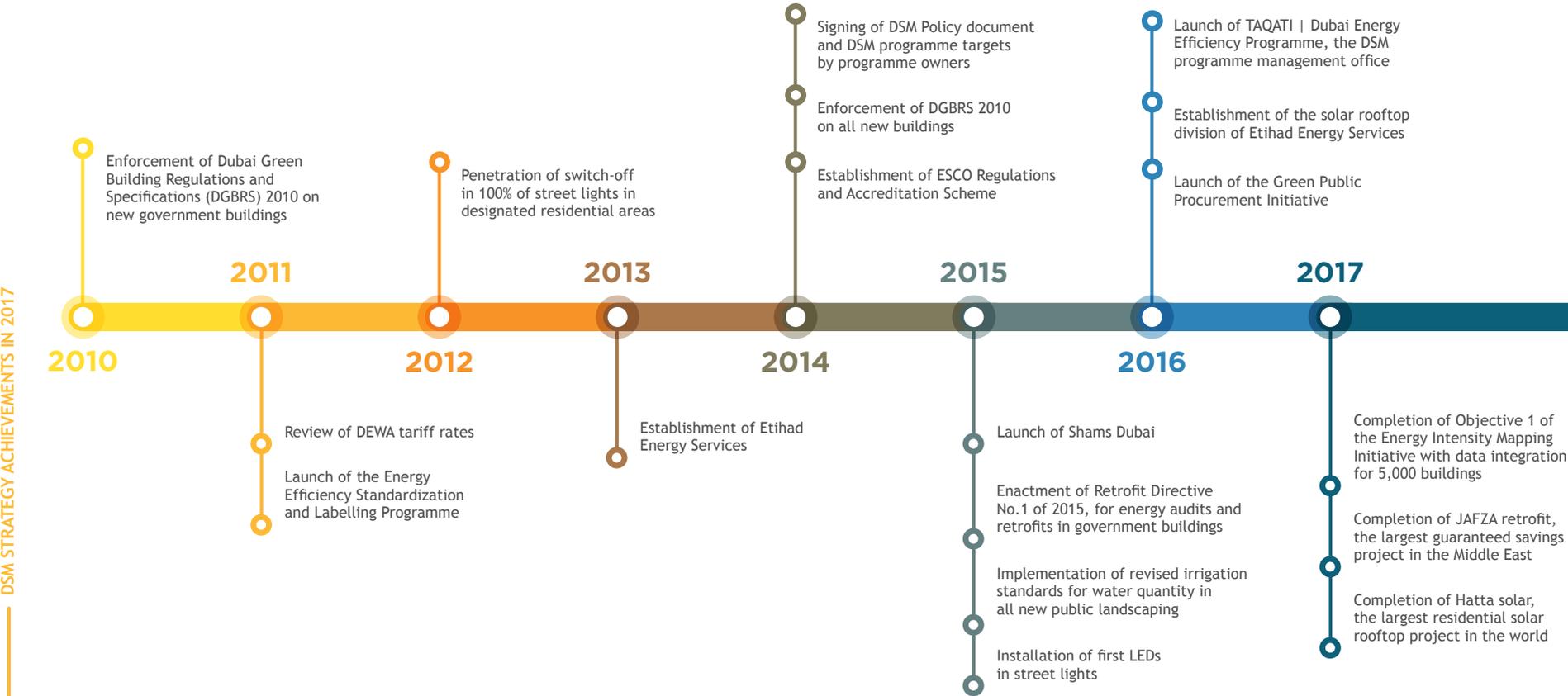


Exhibit 9: Timeline of main Demand Side Management achievements in Dubai, from 2010 to 2017

4.2 OVERALL PERFORMANCE IN 2017

Electricity and Water Savings

The Demand Side Management (DSM) performance continues to show momentum in 2017. At the end of 2017, DSM programmes have saved 3.3 TWh of electricity, 13% over the 2.9 TWh target for the year, and 4.9 BIG of water, 2% over the 4.8 BIG target for the year. Compared to business as usual consumption, which is the reference for the 30% by 2030 target, those savings represent 7.6% and 4.3% of the total baseline consumption for electricity and water, respectively (see exhibit 10).

IN 2017



Savings of
3.3 Billion
Kilowatt Hours

Reduction of
7.6% vs. Business
as usual

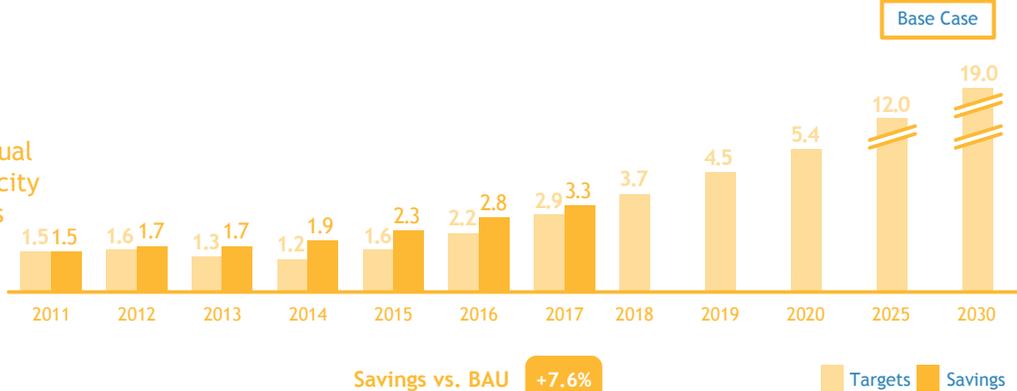


Savings of
4.9 Billion
Imperial Gallons

Reduction of
4.3% vs. Business
as usual



A. Annual
Electricity
Savings
(TWh)



B. Annual
Water
Savings
(BIG)

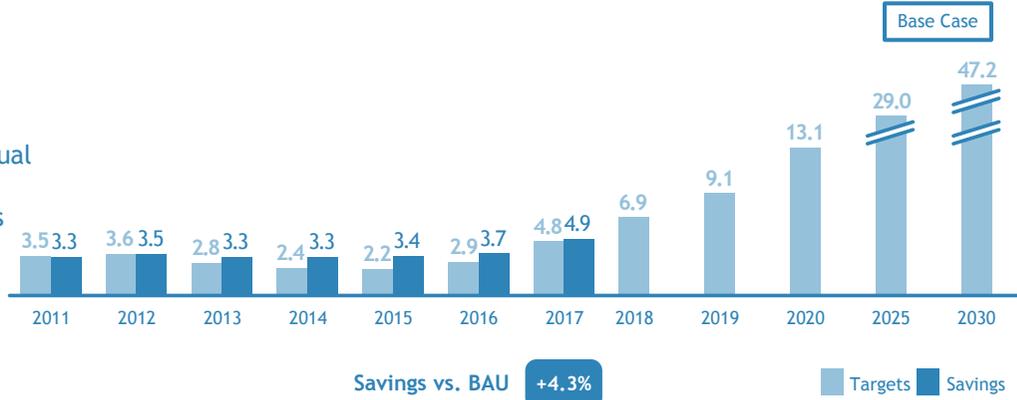


Exhibit 10: Actual annual savings achieved from the implementation of DSM programmes versus target savings (A. Annual electricity savings B. Annual water savings)

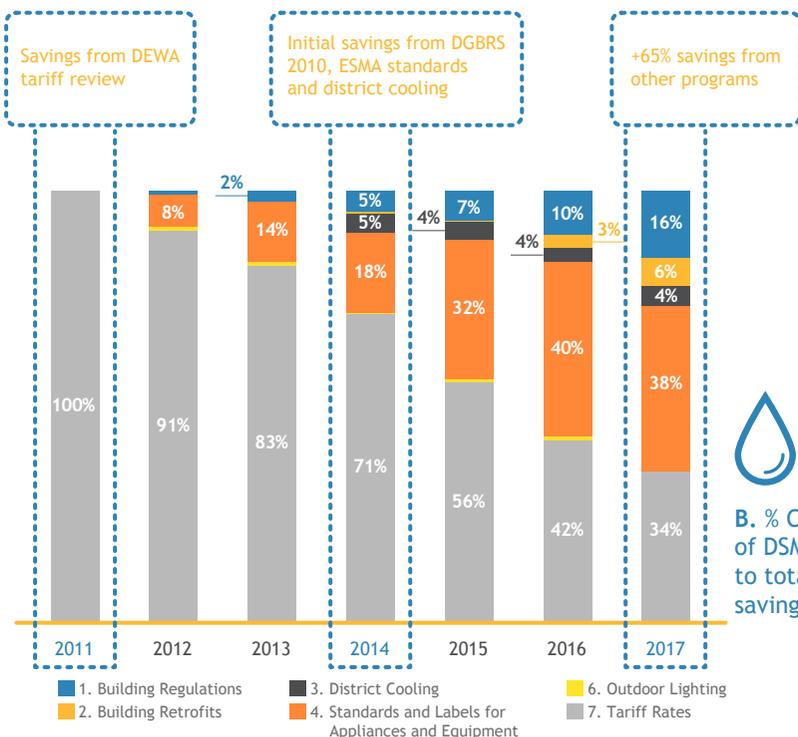
Contribution of DSM Programmes to Savings

The impact of the tariff review applied in 2011 by Dubai Electricity and Water Authority (DEWA) is still significant, but its share of the overall DSM savings has been decreasing; on one hand, due to the natural degradation of the price signalling effects of tariff reforms over time, and, on the other hand, as a result of more substantial savings from other DSM programmes (see exhibit 11).

DSM STRATEGY ACHIEVEMENTS IN 2017



A. % Contribution of DSM programs to total electricity savings



B. % Contribution of DSM programs to total water savings

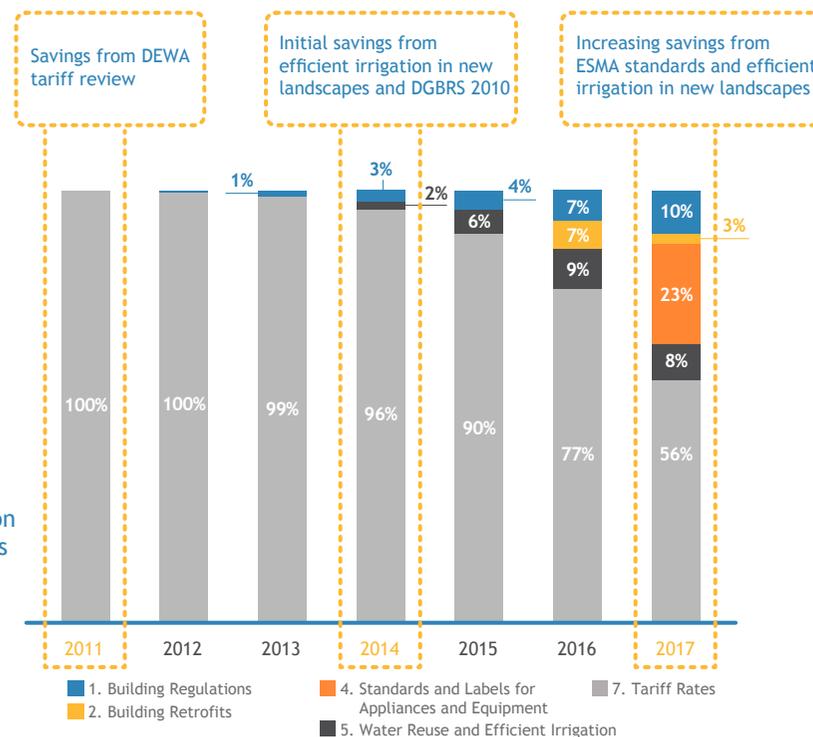


Exhibit 11: Percentage contribution of DSM programmes to the total DSM Strategy savings, for years 2011 to 2017 (A. Electricity savings and B. Water savings)

Reduction in Consumption per Capita

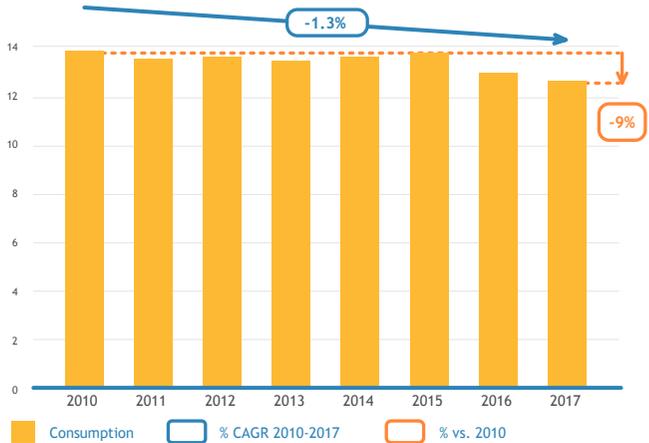
An encouraging trend that has been observed in 2016 and again in 2017 is the consistent reduction in per capita consumption for both electricity and water. Electricity consumption dropped by 2.8% in comparison to the consumption in 2016 while water consumption dropped by 3.8%. The sustained results confirm the positive impact of DSM programmes on unitary consumption. Looking at long term trends, since the inception of the DSM Strategy, consumption per capita has decreased by an annual average of 1.3% for electricity and 1.7% for water, which is in line with other important, successful DSM programmes around the world (see exhibit 12).



1. Population figures used in the calculation are an estimate of the Equivalent Permanent Population of Dubai, which comprises residents of Dubai, and a weighted contribution from people working in Dubai but residing in neighbouring emirates and from tourists.
2. Total consumption exhibited is at end-user level and excludes power stations and desalination auxiliaries, as well as losses in the transmission and distribution networks.



A. Electricity Consumption per capita year ('000 kWh)



B. Water Consumption per capita year ('000 IG)

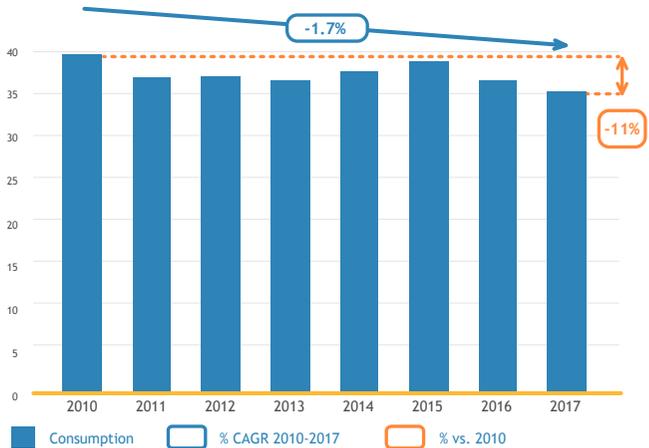


Exhibit 12: Trends in per capita consumption, showing the compounded annual growth rate (CAGR) and total decrease in consumption from 2010 to 2017 (A. Electricity consumption per capita B. Water consumption per capita)





A. Annual Electricity Savings by DSM programme in 2017 versus targets and 2016

DSM Programme	2016 Savings (GWh)	2017 Savings (GWh)	2017 Target (GWh)	Delta YoY (%)	Deviation vs. target (%)	Notes on the results
 Building Regulations	284	524	246	84%	113%	Savings are based on data received from Dubai Municipality and Trakhees on green buildings commissioned
 Building Retrofits	88	194	75	120%	159%	Increase in savings mainly results from a 300% increase in savings from private ESCO (non-Etihad ES) projects
 District Cooling	92	176	185	91%	-5%	Savings are based on data received from the five main district cooling operators in Dubai
 Standards and Labels	1,126	1,256	1,364	12%	-8%	Savings result from enforced efficiency standards for unit air conditioners, indoor lighting, refrigerators and washing machines
 Outdoor Lighting	13 ⁽¹⁾	15	25	15%	-41%	Data collection is currently limited to RTA and DM, excluding savings from outdoor lighting by other developers. As part of the DSM Strategy refresh update, targets will be potentially adjusted/ broken down by entity
 Tariff Rates	1,188	1,125	1,046	-5%	8%	Decrease in savings is due to the gradually decreasing effect of 2011 tariff review
 Shams Dubai	8.5	23	n/a	171%	n/a	Increase in savings results from an increase in connected capacity from 7.3 MW in 2016 to 22.6 MW in 2017
Grand Total	2,807	3,312	2,940	18%	13%	
Total as % of baseline	6.8%	7.6%	6.8%			

Exhibit 13: A. Actual annual electricity savings by DSM programme in 2017 versus 2017 targets and 2016 savings

(1) 2016 savings were readjusted due to updated data received by RTA and for the purpose of comparing them with 2017 savings





B. Annual Water Savings by DSM programme in 2017 versus targets and 2016

DSM Programme	2016 Savings (MIG)	2017 Savings (MIG)	2017 Target (MIG)	Delta YoY (%)	Deviation vs. target (%)	Notes on the results
 Building Regulations	259	472	818	82%	-42%	Deviation from target could be explained by an underestimation of the water baseline intensity, which is being investigated
 Building Retrofits	246	132	262	-46%	-50%	Decrease in savings from last year is due to de-scoping water measures in a major retrofit project
 Standards and Labels	n/a	1,134	1,246	n/a	-9%	Savings result from enforced efficiency standards for indoor water fixtures. Deviation from target is due to a delay in enforcing water efficiency standards versus the anticipated enforcement date
 Water Reuse and Efficient Irrigation	346	409	274	18%	49%	Savings result from revised irrigation standards for water quantity applied to new public landscapes
 Tariff Rates	2,886	2,738	2,189	-5%	25%	Decrease in savings is due to the gradually decreasing effect of 2011 tariff review
Grand Total	3,737	4,885	4,788	13%	2%	
Total as % of baseline	3.4%	4.3%	4.2%			

Exhibit 13: B. Actual annual water savings by DSM programme in 2017 versus 2017 targets and 2016 savings



Reduction in Carbon Emissions

An important impact of savings on electricity and water consumption is the reduction in carbon dioxide (CO₂) emissions resulting from avoided electricity and water generation, which today relies in large part on non-renewable sources. (see exhibit 15).

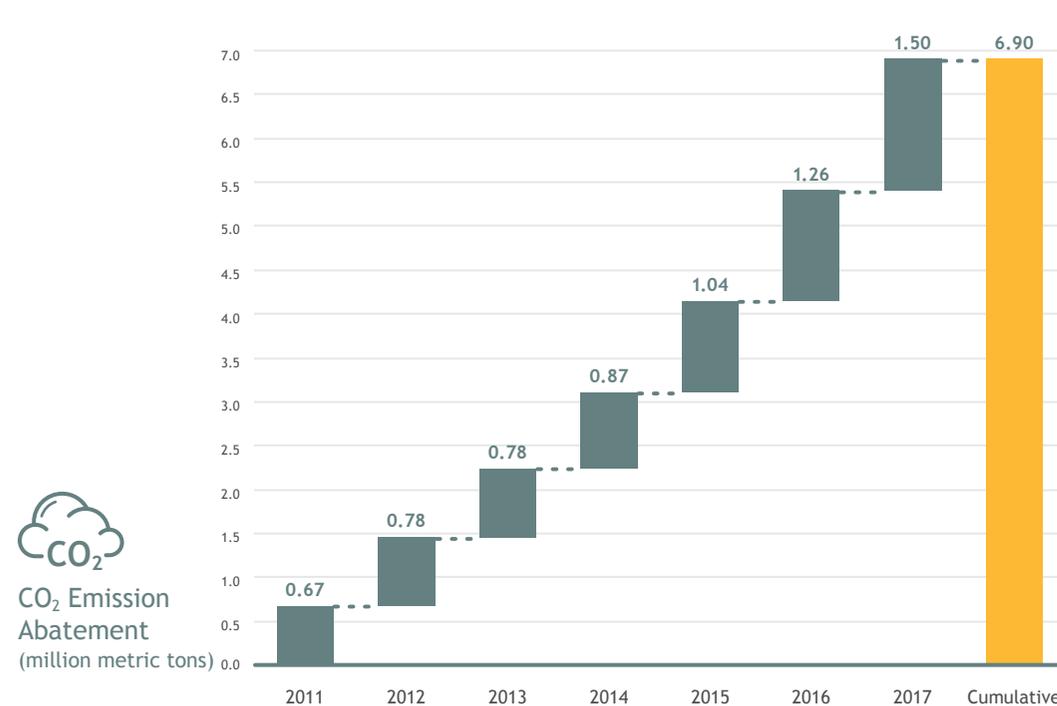


Exhibit 15: Cumulative carbon dioxide emission abatement from DSM programmes, from 2011 to 2017

SINCE 2011

Avoided

7 Million
Metric Tons of CO₂

Equivalent to
emissions from

1.3 Million cars
driven in Dubai
for 1 full year

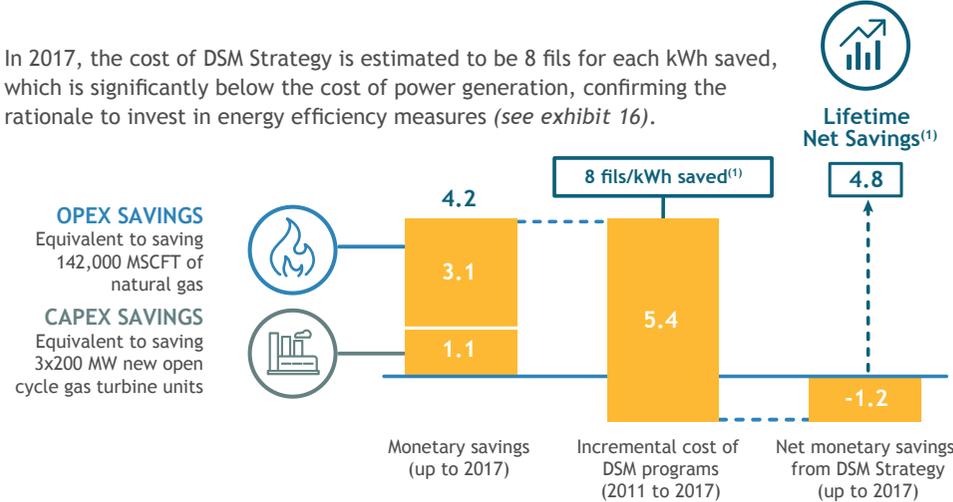


4.3 MONETISING DEMAND SIDE MANAGEMENT SAVINGS

Savings in electricity and water consumption translate into economic savings in the form of avoided cost and freed up resources that can be diverted to other purposes.

The Total Resource Cost (TRC) Test measures the net benefits of the DSM Strategy from the perspective of all participants, including DSM programme owners (with DEWA as both the utility and programme owner), implementing entities (developers, ESCOs, district cooling operators), and end users (DEWA customers). On a consolidated basis, i.e., considering DSM participants as a whole, the net benefits of the DSM Strategy weighs monetary savings, lower operating costs (e.g., generation fuel cost) and avoided capital investments for new generation capacity and equipment; against incremental cost brought about by the DSM programmes and Strategy (equipment, administrative and overhead costs).

In 2017, the cost of DSM Strategy is estimated to be 8 fils for each kWh saved, which is significantly below the cost of power generation, confirming the rationale to invest in energy efficiency measures (see exhibit 16).



DSM STRATEGY ACHIEVEMENTS IN 2017

SINCE 2011



Saved
4.2 Billion AED in operational costs and capital investments

Equivalent to
142,000 Million Standard Cubic Feet of natural gas

3x 200 Megawatt open cycle gas turbine units

NOTES All values are in Billion AED
(1) Calculated over the lifetime of installed equipment and implemented measures from 2011 to 2017. Future monetary savings are discounted with a 5% yearly rate.

Exhibit 16: Total Resource Cost Test results for the DSM Strategy from 2011 to 2017

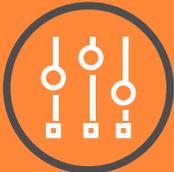
Based on the TRC test, the net present value of savings that Dubai stands to achieve out of investments made since 2011 on DSM related measures and equipment, is AED 4.8 Billion.

In addition to its direct benefits, the DSM Strategy brings several indirect benefits to Dubai. This more extended set of advantages includes, environmental conservation, positive impact on residents' health, job creation, reinvestment of saved resources, and attraction of investments resulting from a more sustainable and efficient city.

With all the valuable socio-economic and financial benefits, the Dubai Government is strongly committed to addressing any challenges the DSM Strategy may face along the way.

5

DEEP DIVE ON DSM PROGRAMMES AND INITIATIVES



BUILDING REGULATIONS



BUILDING RETROFITS



DISTRICT COOLING



STANDARDS AND LABELS



WATER REUSE
AND IRRIGATION



OUTDOOR LIGHTING



TARIFF RATES



SHAMS DUBAI



DSM PROGRAMME 1:
**BUILDING
REGULATIONS**

PROGRAMME OWNER



PROGRAMME SCOPE

Implement Dubai Municipality's (DM) existing green building regulations in new buildings and update regulations to double electricity and water savings.



HE DAWOOD AL HAJIRI

Director General, Dubai Municipality

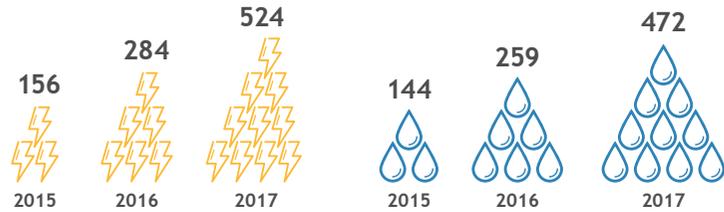
Visit www.dm.gov.ae





BUILDING REGULATIONS

PROGRAMME SAVINGS



Electricity Savings (GWh)

Water Savings (MIG)

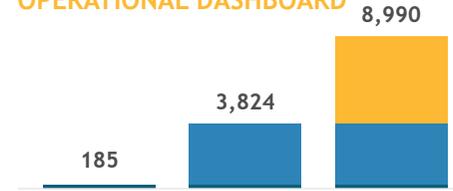
PROGRAMME INTRODUCTION

At the current economic pace, Dubai is expected to continue its aggressive growth path, making buildings one of the key contributors to energy consumption in the emirate.

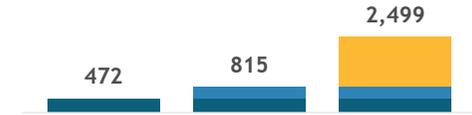
Dubai Municipality issued the first comprehensive compilation of regulations in 2010. In January 2011, the Dubai Green Building Regulations and Specifications (DGBRS) 2010 was made mandatory on all new government buildings, and in March 2014, after testing the code across more than 40 buildings, it was enforced on the private sector.

DGBRS 2010 is estimated to bring 20% electricity and water savings in new buildings compared to pre-DGBRS buildings. Building Regulations has the highest impact among all DSM programmes, about 30% of the overall targets. To achieve the targets, the Demand Side Management (DSM) Strategy relies on the full implementation of DGBRS 2010 and updates to the regulations in 2022 resulting in 25% additional savings.

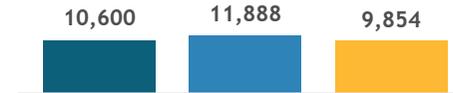
OPERATIONAL DASHBOARD



Cumulative number of commissioned buildings compliant to DGBRS 2010 permitted by DM



Cumulative number of commissioned green buildings permitted by Trakhees



Annual number of DGBRS 2010 compliant building permits issued by DM



DGBRS 2010 penetration out of total gross floor area of commissioned buildings permitted by DM



DGBRS 2010 penetration out of total gross floor area of buildings permitted by DM

Legend:





MAIN ACHIEVEMENTS

1 AL SA'FAT, DUBAI'S GREEN BUILDING EVALUATION SYSTEM

As building permits issued have reached 97% compliance to DGBRS 2010 in 2017 and in light of the growing willingness of developers and building owners to exceed minimum DGBRS 2010 standards, DM has developed Al Sa'fat, a green building evaluation system to boost recognition of higher energy efficiency buildings.

Al Sa'fat leverages the work done on DGBRS 2010. It is also a prescriptive code, which, first, defines minimum mandatory standards to be followed for each building component. Provided minimum standards are fulfilled, developers can choose to meet additional prescriptive requirements and achieve the Gold or Platinum Sa'fat ratings (*see exhibit 17*). By giving recognition to those proactive efforts, Al Sa'fat opens the way to market mechanisms that would eventually allow reflection on property prices and rents.

The first version of the code (v1.0) was circulated in September 2016, and, in 2017, campaigns and seminars were held to raise awareness on the new code. Additionally, DM carried out a number of workshops with developers, consultants, and other stakeholders to gather practical feedback from the market. Accordingly, DM has amended some regulations and developed a guidebook to guide the implementation of the code.

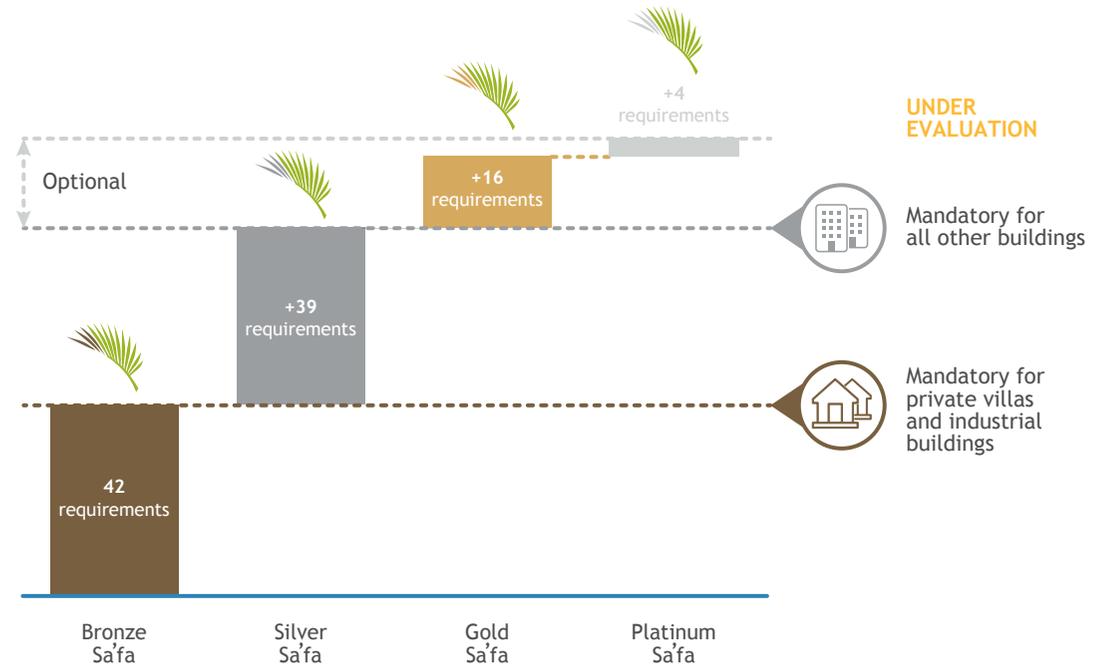


Exhibit 17: Al Sa'fat evaluation system (v1.1, with update on mandatory standards for each building type communicated in Circular 222 of 2017)





**BUILDING
REGULATIONS**

PRIORITY AREAS

DEEP DIVE ON DSM PROGRAMMES AND INITIATIVES

1

LAUNCH OF AL SA’FAT

DM plans to finalise amendments and launch the Sa’fat evaluation system in quarter four of 2018.

2

**UNIFYING GREEN BUILDING
REGULATIONS ACROSS FREE ZONES**

DGBRS 2010 is only applied in few free zones which rely on DM for building permitting. Other free zones adopt different green building regulations, even if these are partially in line with DGBRS 2010. Beyond the loss of energy saving opportunities resulting from lower efficiency standards in some free zones, differences in methodologies and requirements cause inefficiencies in the real estate value chain.

Shared regulations would bring benefits to all stakeholders: higher compliance to regulations for authorities, lower design and contractor service costs for developers, and eventually reduced final cost for customers.

DID YOU KNOW?

Nearly zero energy buildings (nZEBs) are buildings with nearly zero energy use intensity, and the low amount of energy these buildings require typically comes from on-site or off-site renewable energy sources.

In a survey conducted by the Emirates Green Building Council in 2017 as part of their report on the adoption of nZEBs in the UAE, “Defining Nearly Zero Energy Buildings in the

UAE”, 65% of survey participants responded that they believe the UAE market is ready to implement an nZEB strategy between 2020 and 2030. Actually, early adopters of the nZEB concept already exist in the UAE with a number of demonstrable cases in the market (see exhibit 18).

nZEB is a globally adopted concept. In fact, the United States, Australia and some

European Union member states have set clear nZEB targets and a timeline for full implementation of the concept in new buildings by 2020 and 2030.

The same study finds that, considering the climatic conditions and taking a cost-effective approach, an nZEB in the UAE can be defined as a site with energy use intensity lower than 90 kWh/m²/year.

* The survey involved 55 respondents, including developers, consultants, government officials and academics in the construction sector.

3

**PROMOTING HIGHER SA’FAT RATINGS
AND NEARLY ZERO ENERGY BUILDINGS**

Another priority for the coming years is to promote the adoption of Gold and Platinum Sa’fat ratings, in line with the growing adoption of nZEBs globally.

It is important for Dubai’s buildings to begin moving towards a near zero energy consumption in order to remain in line with global developments and support the targets of the Dubai Demand Side Strategy.





**BUILDING
REGULATIONS**

**The Sustainable Autonomous House
by the Mohammed Bin Rashid Space
Centre (MBRSC)**

The Autonomous House, constructed by the MBRSC engineers, is the first passive house in a hot and humid climate and in the MENA to be certified by the Passive House Institute (Germany). The certification was received on August 21, 2016.

The house also received the 2017 MENA Green Building Award in the green residential building category and the Emirates Energy Gold Award in the small project category.

The house was designed in a way that respects the natural and local environment and is a model for future designs in the real-estate development sector in the UAE.



**nZEB recipe: insulation, smart technology,
solar and great design**

Overview of the engineering design features of the house:

- The envelope is designed with engineered wood structure, wool insulation, and triple glazing windows that ensure minimal thermal loss.
- Appliances and equipment used are highly efficient, and smart technology is employed to maintain indoor temperature and enable remote sensing of light fittings.
- The Sustainable Autonomous House, which is completely off the grid, is powered by solar energy. The roof hosts 161 solar panels that generated 48,210 kWh in 2017.
- Due to its highly insulating and smart design materials, the house consumes only 50% of the electricity produced by the panels. The surplus of energy is stored in batteries and transferred to the neighbouring buildings.



Exhibit 18: A case study on net-zero energy buildings in Dubai





DSM PROGRAMME 2:
**BUILDING
RETROFITS**

PROGRAMME OWNER

Etihad **الانسان**
Energy Services لخدمات الطاقة



مكتب التنظيم والرقابة لقطاع الكهرباء و المياه
RSB FOR ELECTRICITY & WATER

PROGRAMME SCOPE

Retrofit the existing building stock in Dubai with electricity and water efficiency measures in the aim of reducing energy intensity of up to 30,000 buildings in Dubai by 2030.



ALI MOHAMMED AL JASSIM

CEO, Etihad Energy Services

Visit www.etihadesco.ae



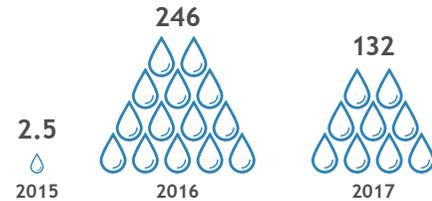


**BUILDING
RETROFITS**

PROGRAMME SAVINGS



Electricity Savings (GWh)



Water Savings (MIG)

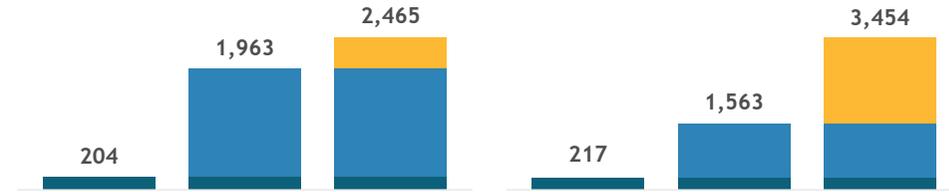
PROGRAMME INTRODUCTION

Dubai Government launched Dubai's Retrofit Programme by setting-up a super energy service company (super-ESCO) in 2013, Etihad Energy Services Company (Etihad ES), with the role of developing the energy performance contracting (EPC) market in Dubai and attracting industry players, ESCOs, to provide technical services.

In parallel, the Regulatory and Supervisory Bureau for Electricity and Water in Dubai (RSB) has regulated the EPC market by defining an accreditation scheme for ESCOs in 2014 and one for Energy Auditors a year later.

To stimulate market demand and to govern by example, the Dubai Supreme Council of Energy (DSCE) enacted Directive No. 1 of 2015, which mandates walkthrough energy audits in all government buildings greater than 1000 m², and detailed energy audits and retrofits when expected energy savings are greater than 20% and payback is lower than 10 years. The directive targets 20% water and electricity savings from government entities by 2021.

OPERATIONAL DASHBOARD



Cumulative number of retrofitted buildings

Cumulative number of building equivalents (average sized building)



Average electricity savings from retrofit projects versus baseline consumption

Number of accredited ESCOs



Number of accredited auditors





BUILDING RETROFITS

MAIN ACHIEVEMENTS

1 MARKET GROWTH AND LARGE SCALE RETROFIT PROJECTS

The regulated EPC market has seen substantial growth in the past four years. Since the establishment of Etihad ES and the regulation of the market, 2,465 buildings have been retrofitted by Etihad ES and the 21 accredited ESCOs. In 2017, total annual electricity savings from reported projects have doubled to 194 GWh, noting that this figure does not include retrofits carried out by non-accredited ESCOs.

For Etihad ES, 2017 included the retrofit of 157 labour accommodation buildings in Jebel Ali Free Zone (JAFZA), the largest guaranteed energy saving project in the Middle East, and a lighting retrofit project for 1,658 villas in Mohammed Bin Rashid Housing Establishment (see exhibit 19 A.).

While completing these large scale projects, Etihad ES also initiated two other major retrofit projects, one of AED 69 million with wasl properties (see exhibit 19 B.) and another of AED 140 million with Dubai Airports.

A. Mohammed Bin Rashid Housing Establishment, a DEWA corporate social responsibility project

- a. **Project Scope:**
Lighting retrofit of 1,658 villas:
 - 89,638 inefficient lighting fixtures replaced with LEDs. Old lights were recycled
- b. **Project Financing:**
Investment value of AED 3.1 million, financed by DEWA as a corporate social responsibility project
- c. **Project Execution:**
Led by Etihad ES and executed by Smart4Power
- d. **Project Savings:**
Five years guaranteed savings contract of:
 - AED 0.6 million per year
 - 80% electricity savings or 6.4 GWh/year



B. Wasl properties, a guaranteed savings project

- a. **Project Scope:**
Retrofit of common areas in 243 buildings (some 30 years old):
 - 95,000 old lighting fixtures replaced with LEDs
 - Deep retrofit of HVAC system
 - 5 MWp solar photovoltaic (PV) system installed
- b. **Project Financing:**
Investment value of AED 69 million
- c. **Project Execution:**
Led by Etihad ES and executed by SmartAE
- d. **Project Savings:**
Five years guaranteed savings contract of:
 - AED 14.8 million per year
 - 26.2% electricity savings or 33.3 GWh/year



Exhibit 19: Overview of the large scale retrofit projects carried out in 2017 by Etihad Energy Services



BUILDING RETROFITS

Etihad ES uses a business model that aims at facilitating financing for retrofit projects in the government sector. It is a guaranteed savings model that provides financing through a Shari'a compliant structure, created in partnership with the National Bond Corporation. The model (see exhibit 20) was first applied to the JAFZA project, and has since been applied with some variations to other projects led by Etihad ES.

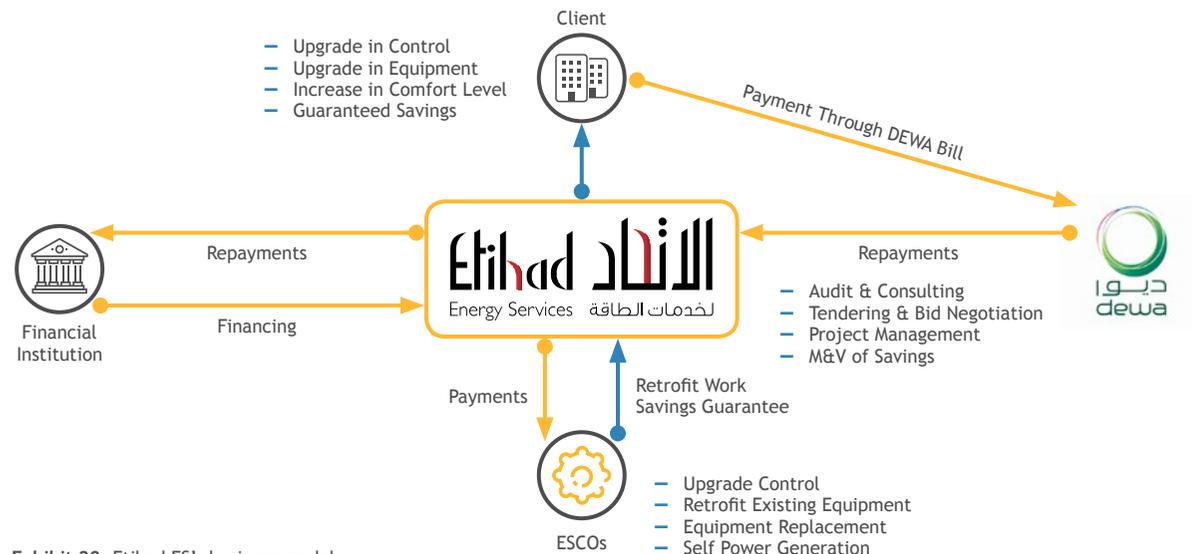


Exhibit 20: Etihad ES's business model

As for accredited ESCOs, the growth trend is very positive. Reported savings from retrofit projects have quadrupled again in 2017 as they had in 2016.

2 STUDY ON BUILDING ENERGY RATING SCHEME FOR DUBAI

In parallel, in 2017, the RSB conducted a study as a first step in the development of a rating scheme that enables existing buildings in Dubai to be rated for their electricity and water efficiency performance. The scheme is one of the major upcoming initiatives planned in the DSM Strategy; it will help make energy efficiency more visible, will enable the real estate market to truly value a building's efficiency performance, and ultimately it will work as a tool to improve efficiency in the built environment.



**BUILDING
RETROFITS**

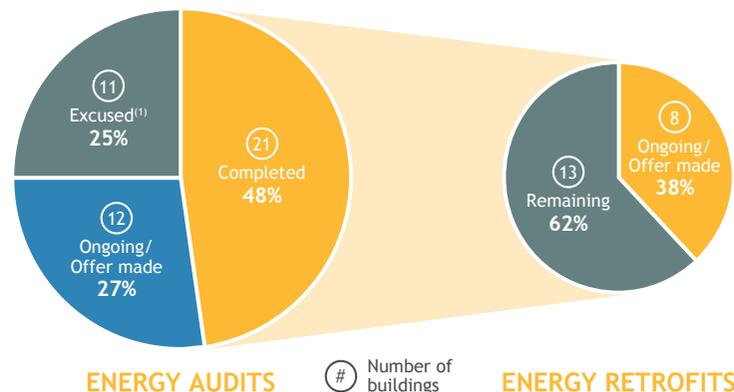
PRIORITY AREAS

**1 STIMULATING THE MARKET
FOR WATER RETROFITS**

While actual electricity savings surpassed target savings by 59% in 2017, water savings from reported projects did not meet pre-set target savings. The gap could be due to unaccounted for savings as the majority of water retrofit projects are carried out by facility management companies or other non-accredited ESCO companies. The gap could also be the result of other factors specific to water retrofits: the business case is not as attractive as it is for electricity retrofits, or the market to address is harder to tap into (i.e. national villas and labour accommodation as opposed to government buildings which are easier to access yet have low water usage). Therefore, it is important to investigate the causes further and stimulate water retrofit projects in the coming years.

**2 GOVERNING BY EXAMPLE,
IMPLEMENTING DIRECTIVE NO.1 OF 2015**

Eight government entities have so far retrofitted their facilities while another 13 entities have completed the energy audit preceding the retrofit (see exhibit 21). Etihad ES will continue to follow up on the progress of the directive's implementation in the coming years.



(1) The government building is excused from energy audit, as energy conservation measures have already been applied or the building is not under the supervision of the entity occupying it

Exhibit 21: Status of Directive No. 1 of 2015

**3 SUPPORTING RETROFIT PROJECTS
IN OTHER SECTORS OR SUBSECTORS**

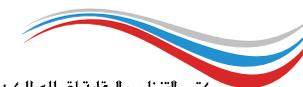
Etihad ES has been facilitating retrofit projects in government facilities; meanwhile accredited ESCOs have been penetrating the commercial and residential sectors. In fact, in 2017, savings from retrofits in commercial and residential buildings represent 80% of contracted electricity savings by accredited ESCOs. On the other hand, retrofits in villas and small medium enterprises (SMEs), in the form of energy efficiency improvements and beyond corporate social responsibility projects, are still low due to lack of awareness, lack of organised support mechanisms, and perceived long term payback period in the absence of affordable funding. In response, Etihad ES is working on developing measures to target the residential and SME sectors (e.g., promotional programmes).





DSM PROGRAMME 3:
**DISTRICT
COOLING**

PROGRAMME OWNER



مكتب التنظيم والرقابة لقطاع الكهرباء و المياه
RSB FOR ELECTRICITY & WATER

Etihad **الانسان**
Energy Services لخدمات الطاقة

PROGRAMME SCOPE

Increase the penetration of efficient district cooling (DC) to 40% of the total cooling capacity of Dubai in 2030 by regulating the DC market.



GRAEME SIMS

Executive Director,
Regulatory Supervisory Bureau
for Electricity and Water in Dubai
Visit www.rsbdubai.gov.ae





PROGRAMME SAVINGS



Electricity Savings (GWh)

PROGRAMME INTRODUCTION

In Dubai’s hot environment, the cooling load drives significant swings in electricity consumption between winter and summer. Cooling accounts for 50% of the electricity consumption in Dubai and as much as 70% in peak times.

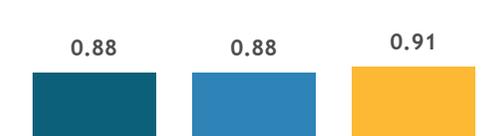
Cooling can be delivered through different technologies. A study carried out by the Regulatory Supervisory Bureau for Electricity and Water in Dubai (RSB) shows that, on average, water-cooled solutions offer superior energy efficiency, 35% to 45% higher than air-cooled alternatives. In high cooling load densities and steady demand, DC is the most efficient water-cooled technology. Hence, the programme aims at increasing DC in Dubai to 40% of the cooling market by 2030, by adopting the technology in new construction projects and by retrofitting old developments.

The programme also expects DC firms to continuously improve the efficiency of their plants against a baseline.

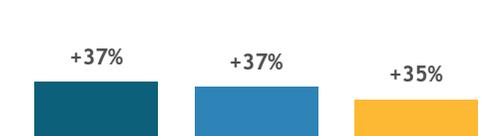
OPERATIONAL DASHBOARD



DC penetration out of total cooling capacity



DC efficiency (in kW/TR)



DC efficiency versus baseline air cooled technology



DC capacity utilisation at peak

Legend:
■ 2015 ■ 2016 ■ 2017





DISTRICT
COOLING

MAIN ACHIEVEMENTS

1 AN IMPROVED MARKET
DATA COVERAGE

DC market data coverage has improved in 2017; saving results encompass data received from the five main DC companies operating in Dubai. The improved coverage will enable better analysis of market share trends and more accurate measurement of savings attributable to increased market share and superior DC efficiency. Savings from the DC Programme amount to 176 GWh in 2017, which is within 5% of the pre-set target savings for 2017 (see exhibit 22).

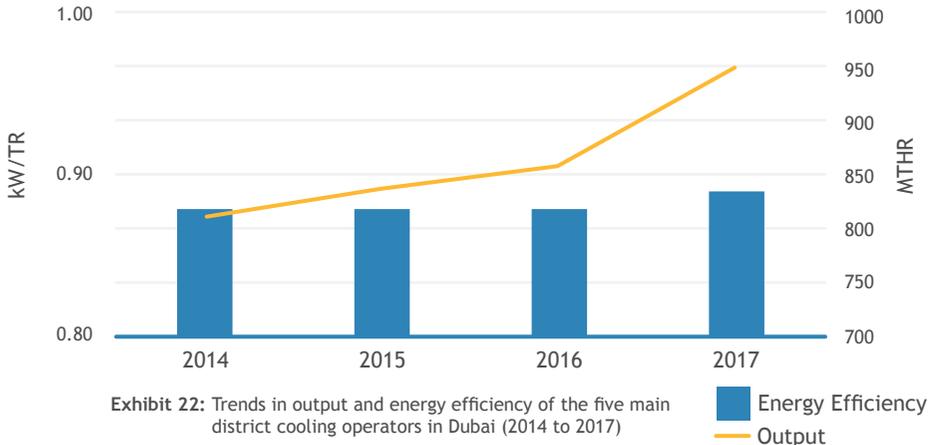


Exhibit 22: Trends in output and energy efficiency of the five main district cooling operators in Dubai (2014 to 2017)

2 CONTINUOUS GROWTH IN DEMAND
FOR TREATED SEWAGE EFFLUENT

DC delivers the greatest benefit when efficient plants are operated using treated sewage effluent (TSE) water. It is therefore encouraging to see that the use of TSE in DC has increased nearly three-fold from just over 270 MIG in 2012 to 670 MIG in 2017. TSE contributed in 2017 to over 40% of all water used in DC plants (see exhibit 23).

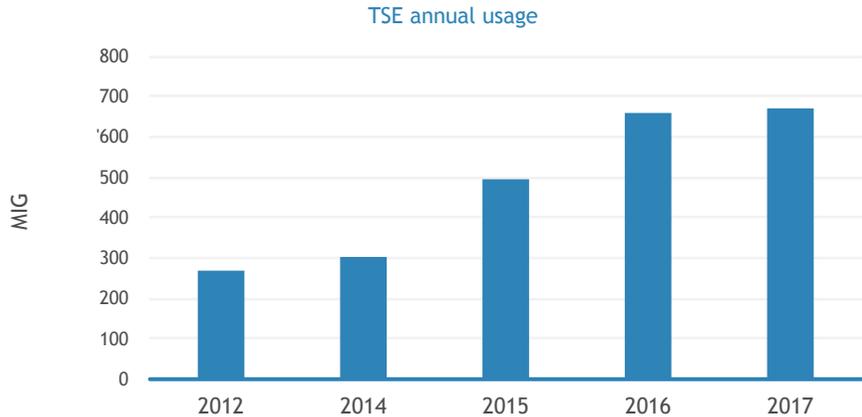


Exhibit 23: Growth in annual usage of treated sewage effluent in district cooling plants in Dubai





PRIORITY AREAS

1 ENACTING A REGULATORY FRAMEWORK

Formal regulation of the DC market in Dubai remains a key issue and is required to ensure that the benefits of DC are shared fairly between the relevant stakeholders: customers, developers, and investors, and that DC continues to offer greater efficiency than alternative cooling technologies.

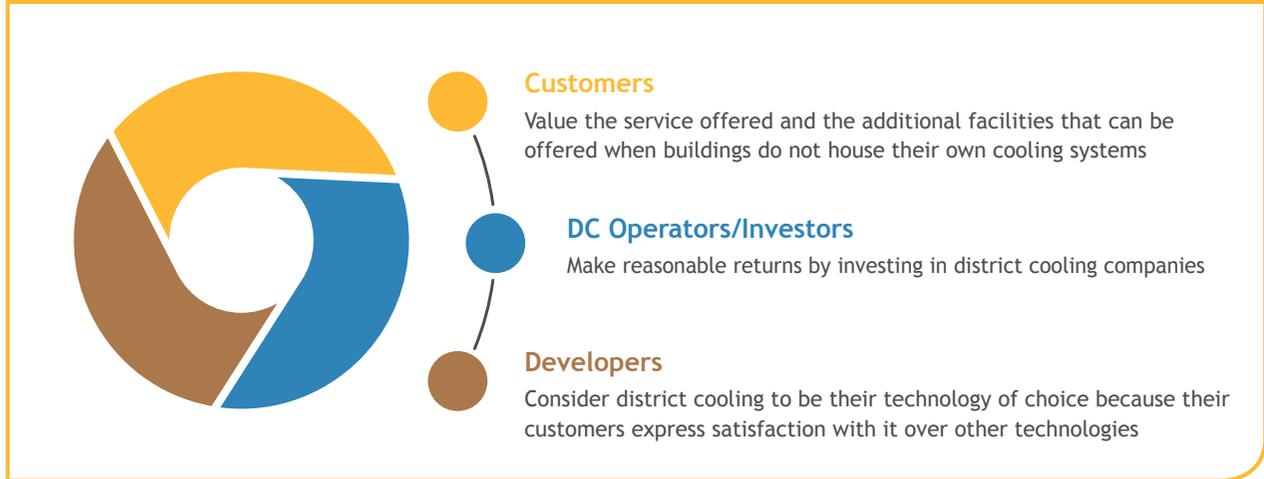


Exhibit 24: Conditions favoring adoption of District Cooling by stakeholders

2 IMPROVING THE AVAILABILITY OF TREATED SEWAGE EFFLUENT

DC providers are making the most of TSE and, as mentioned above, it now accounts for over 40% of all water consumed in Dubai’s DC plants. Dubai Municipality (DM) is actively working to make more TSE available for DC plants in accordance with the Integrated Water Resource Management Strategy, a strategy developed by the Dubai Supreme Council to optimise the use of water resources in Dubai. Forecasted growth in demand for DC will have a corresponding increase in demand for TSE for the cooling process. Hence, another priority for the programme is to ensure that the network enhancements made by DM are aligned to deliver TSE to cooling plants.

DEEP DIVE ON DSM PROGRAMMES AND INITIATIVES





DSM PROGRAMME 4: STANDARDS AND LABELS FOR APPLIANCES AND EQUIPMENT

PROGRAMME OWNER



هيئة الإمارات للمواصفات والمقاييس
Emirates Authority For Standardization & Metrology

PROGRAMME SCOPE

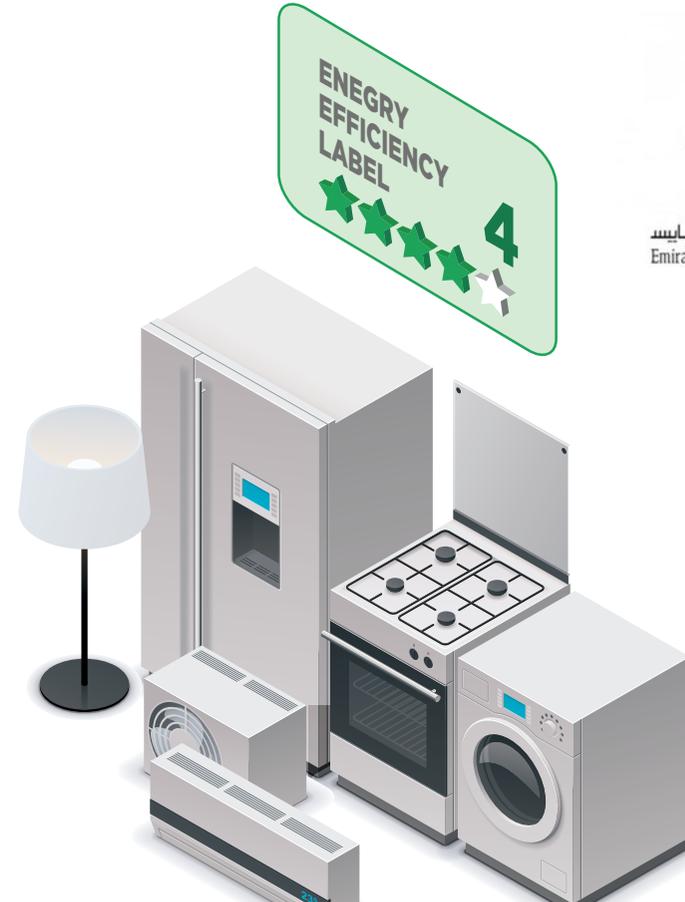
Develop, implement and regularly update electricity and water efficiency standards and comparative labels for high consuming appliances and equipment used in the UAE.



HE ABDULLA AL MAEENI

Director General, Emirates Authority
for Standardization and Metrology

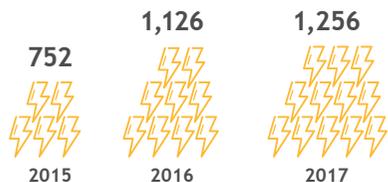
Visit www.esma.gov.ae



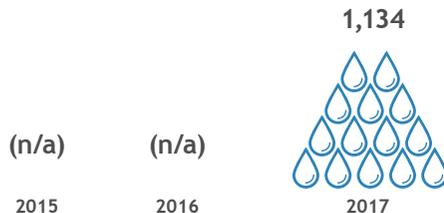


STANDARDS AND LABELS FOR APPLIANCES AND EQUIPMENT

PROGRAMME SAVINGS



Electricity Savings (GWh)



Water Savings (MIG)

PROGRAMME INTRODUCTION

In 2011, the Emirates Authority for Standardization and Metrology (ESMA) introduced the Energy Efficiency Standardization and Labeling (EESL) Programme to prevent the influx of electricity and water inefficient products to the UAE and drive the market towards higher efficiency products.

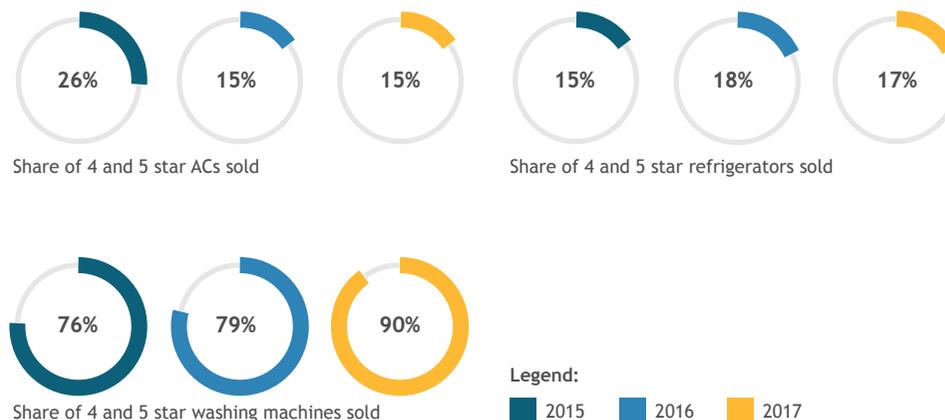
The programme's key mechanisms are the Minimum Energy Performance Standards (MEPS) and the Comparative Labelling Scheme. Regulated electricity and water appliances must comply with minimum performance criteria and receive a certificate from the authority to be legally sold in the market.

Additionally, they need to display a 1 to 5 star label, outlining their level of efficiency (more stars means higher efficiency).

Standards are raised every two to three years for each product category, through consultation with experts and industry players, thus strategically removing less efficient products from the market.

DSM Programme 4 contributes about 22% and 17% of the overall 2030 DSM electricity and water targets. Meeting programme targets relies heavily on public education, in addition to regulatory enforcement, to promote adoption of efficient appliances.

OPERATIONAL DASHBOARD



Legend:
■ 2015
■ 2016
■ 2017





STANDARDS AND LABELS FOR APPLIANCES AND EQUIPMENT

MAIN ACHIEVEMENTS

1 NEW MINIMUM ENERGY PERFORMANCE STANDARDS

Since the launch of the EESL Programme, with the introduction of minimum standards for non-ducted room air-conditioners and adoption of comparative labels, the EESL Programme has strategically expanded to include other high consuming product categories and has undergone several steps of improvement (*see exhibit 25*).

Standards and technical regulations are developed through consultation with the industry, and notification on new draft regulations is sent to the World Trade Organization (WTO). Standards and regulations are then approved by the UAE cabinet before being published in the UAE Official Gazette. Once a regulation is published, ESMA holds meetings with industry players to relay the objectives and technical and administrative requirements for implementing the regulation. OEMs (Original Equipment Manufacturers) and retailers are given a transition period to adjust with the regulation before it is enforced on new products imported to the country, and, at a later stage, on existing products already available for purchase.

In 2017, MEPS for internal water fixtures (basins, showers, etc.) and flushes have been fully enforced. As internal water usage is estimated to correspond to 65% of total water consumption in Dubai (source: Dubai DSM energy model), the standards are expected to have a high impact in reducing water consumption.

DEEP DIVE ON DSM PROGRAMMES AND INITIATIVES

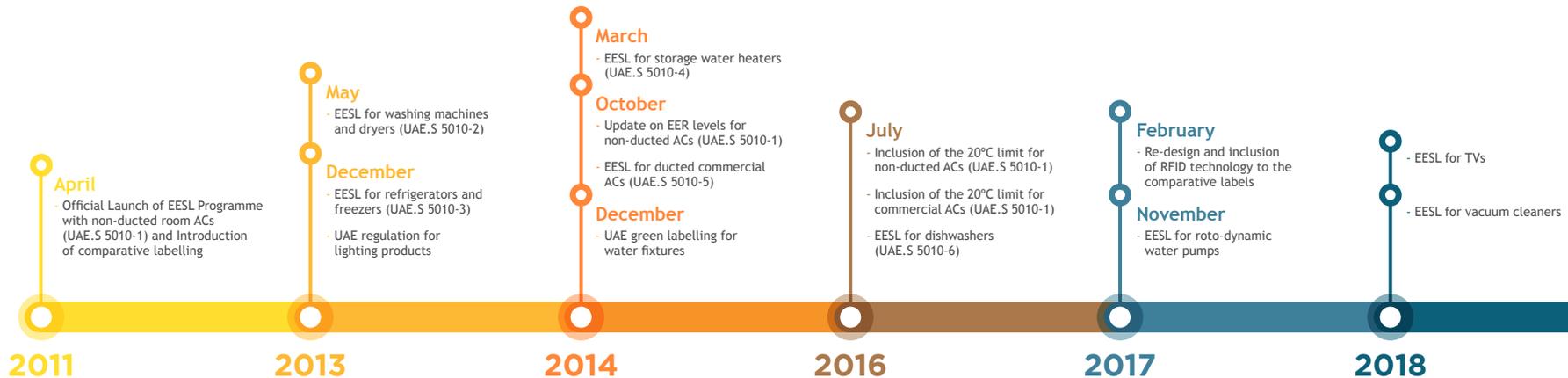


Exhibit 25: Energy Efficiency Standardization and Labeling Programme implementation roadmap (showing publication date of the regulation in the UAE Official Gazette)



STANDARDS AND LABELS FOR APPLIANCES AND EQUIPMENT

2

CRITICAL SUCCESS FACTORS AND ESTABLISHED INITIATIVES ACROSS THE SUPPLY CHAIN

Effective implementation of the programme requires action along the entire supply chain, from import of appliances and equipment to consumer purchase and usage. It consists of enforcing regulation, building awareness and educating consumers to guide their purchase towards higher class appliances, and monitoring and controlling improvement in electricity and water efficiency in the market (see exhibit 26).

Among the latest initiatives to support the EESL programme, ESMA formed a Market Surveillance section in 2016. In Dubai, the section spearheads all market surveillance actions and works in direct collaboration with Dubai Municipality and the Department of Economic Development to test products (some in local laboratories), inspect point of sales, issue fines and recall non-compliant products from the market. In 2017, ESMA reports 89% compliance rate* to the EESL Programme.

Additionally, early 2017, ESMA launched an improved comparative label that utilises RFID (Radio Frequency Identification) and Quick Response (QR) code technologies. This improved design provides better security by preventing tampering, and facilitates inspection. The QR code enables consumers to verify information on the EESL label directly from ESMA secure database.

* The inspection involved visits to 366 point of sales and the testing of 378 products.

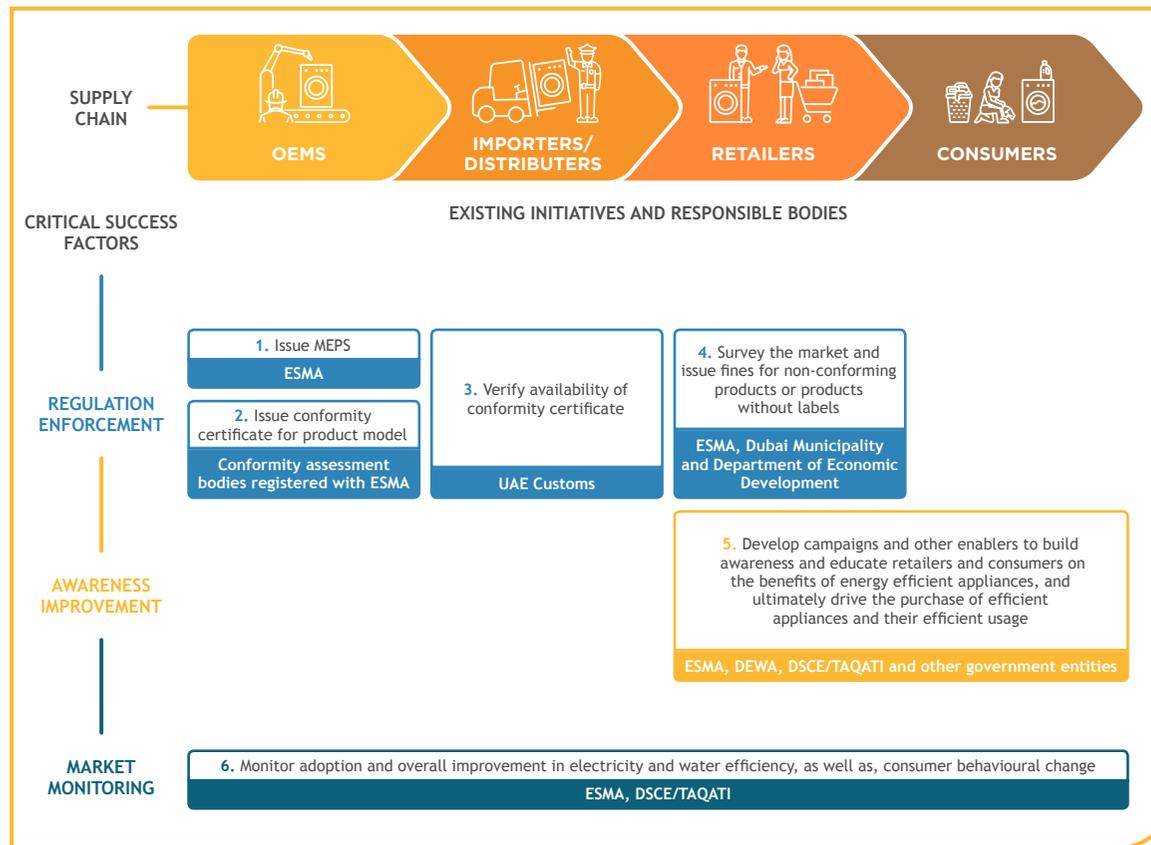


Exhibit 26: Existing Energy Efficiency Standardization and Labeling initiatives in Dubai across the supply chain of appliances and equipment





STANDARDS AND LABELS FOR APPLIANCES AND EQUIPMENT

PRIORITY AREAS

1 INTRODUCING HIGHER STANDARDS AND NEW REGULATIONS

The EESL Programme aims at achieving optimum efficiency in the market by raising the MEPS of products already included in the programme, on one side, and expanding the scope of the programme to new product categories, on the other. For new products, ESMA is planning to issue MEPS for TVs and Vacuum Cleaners in 2018. As for the most energy intensive products already included in the programme (e.g., ACs and water fixtures), raising the MEPS for these products has the highest impact on savings from appliances. It is therefore important to continuously monitor technological advancements in the market and test methods to ensure standards in the UAE are aligned with global standards.

2 UNIFYING STANDARDS AND LABELLING IN THE GULF COOPERATION COUNCIL

Realising the advantages of harmonization, ESMA is in direct collaboration with its counterpart members within the Gulf Standardization Organization (GSO) to develop a unified system of performance standards and labelling scheme. Unification would address cost and complexity implications faced by OEMs and retailers from dealing with different requirements. Similar programmes, such as G-marking of low voltage equipment (LVE) and toys (see exhibit 27.A) and unified labels for vehicles (see exhibit 27.B), are testaments to the Gulf Cooperation Council's (GCC) commitment to harmonization.

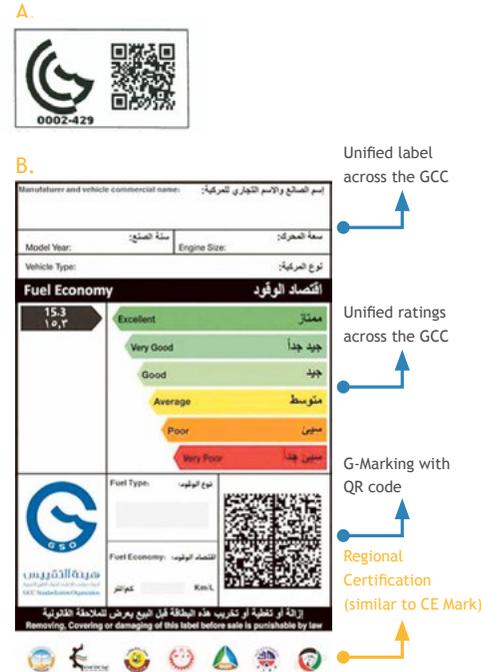


Exhibit 27:

- A. Gulf Standardization Organization Conformity Tracking Symbol (GCTS): G-Marking with the notified body number and a QR code, used across the GCC on regulated appliances, in addition to local label
- B. GCTS label for fuel economy, a unified label used across the GCC for vehicles

3 PROMOTING HIGHER EFFICIENCY PRODUCTS

Despite the on-going efforts led by ESMA, DEWA, and other entities to cultivate public awareness, a market survey conducted by TAQATI in 2017* to examine levels of awareness in energy efficiency among Dubai residents shows that only half of the general public takes into consideration the energy efficiency performance of an appliance before purchasing it while only a third is aware of the existence of ESMA labels.

Programme four stakeholders are working on ways to increase the availability of higher efficiency (four and five star) models in the local market and promote these models to consumers. As reported by ESMA, 78% of ACs sold in 2017 are 1, 2 and 3 star rated models.

Through the enactment of the Green Public Procurement for Energy and Water Efficiency Directive in 2015, the government has already begun the efforts to promote highly efficient appliances. In fact, DSCE member entities have adopted high efficiency for lighting purchases, while criteria for the purchase of other energy intensive product categories are being tested (see section 5.10 on Green Public Procurement for Energy and Water Efficiency).

* The market survey involved 1,500 respondents from the general public.





DSM PROGRAMME 5:
**WATER REUSE AND
EFFICIENT IRRIGATION**

PROGRAMME OWNER



PROGRAMME SCOPE

Irrigate all public areas with treated sewage effluent water (TSE), implement efficiency measures in Dubai's green areas and use excess capacity of TSE for other uses (e.g., private irrigation and DC).



TALIB JULFAR

Assistant Director General,
Environment and Public Health Services,
Dubai Municipality

Visit www.dm.gov.ae





**WATER REUSE AND
EFFICIENT IRRIGATION**

PROGRAMME SAVINGS



Water Savings (MIG)

PROGRAMME INTRODUCTION

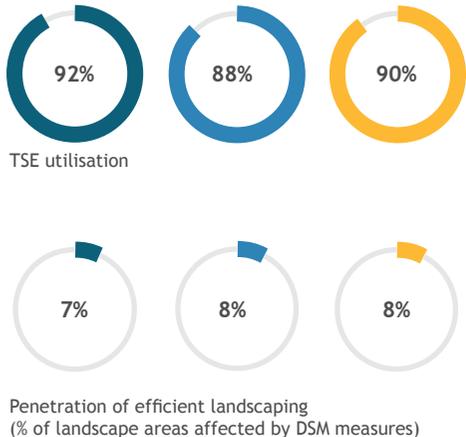
TSE water's use in public irrigation has enabled Dubai to increase its green spaces while saving about 49 BIG of desalinated water, annually, in 2017. The TSE network of Dubai is one of the largest in the world, making the emirate a global best practise in the field.

The Demand Side Management (DSM) Strategy recognises the value of TSE as an asset for Dubai and aims to optimise its consumption to divert excess volumes to other purposes which currently rely on desalinated water: private irrigation, district cooling (DC), and other industrial uses. In fact, Executive Council Resolution No. 27 of 2008 dictates the

use of TSE in DC plants. The low TSE prices, which are more than 80% below desalinated water rates for most customer groups, drive significant market demand for it.

Dubai Municipality (DM) has already started applying measures to reduce consumption of TSE for public irrigation and free up volumes for other purposes. For example, a one-day-per-week switch-off programme has been implemented in some communities during the summer. Additionally, new irrigation standards for water quantity were defined for each plantation type and are being adopted in new communities.

OPERATIONAL DASHBOARD



Legend:
■ 2015
■ 2016
■ 2017

DEEP DIVE ON DSM PROGRAMMES AND INITIATIVES



WATER REUSE AND EFFICIENT IRRIGATION

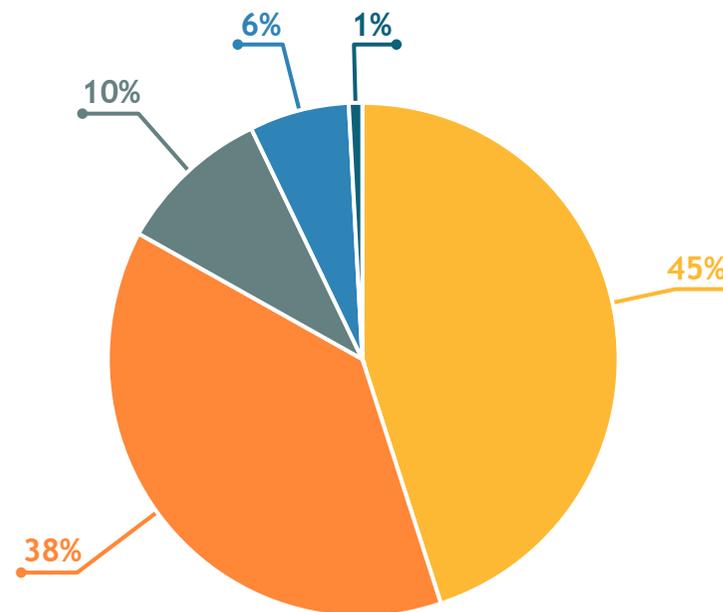
MAIN ACHIEVEMENTS

1 USE OF EXCESS TREATED SEWAGE EFFLUENT BEYOND PUBLIC IRRIGATION

The use of TSE water beyond irrigation of public spaces has increased in the past few years. In 2017, 44% of TSE was sold to private developers and farms (see exhibit 28), yet its use in these private sectors is still mostly limited to irrigation. Demand for TSE is also increasing in DC plants; in 2017, TSE contributed to over 40% of all water used in the plants (see exhibit 23).

2 SEWAGE SYSTEM EXPANSION PROJECTS

The sewage system in Dubai runs on a 1,100 km distribution network and two sewage treatment plants (STPs), one in Al Aweer and the other in Jebel Ali, with a total treatment capacity of 149 MIG/day. As part of DM's sewage system expansion efforts, in 2017, the irrigation line on Sheikh Zayed road was extended to the Abu Dhabi boarders. Additionally, construction work for the expansion of the Jebel Ali STP has been initiated. Phase two of the plant will increase its treatment capacity by 80%, from 82 MIG/day to 148 MIG/day.



- Used in the irrigation of public landscapes (by Dubai Municipality)
- Sold to private developers
- Used in governmental establishments
- Sold to private farmers
- Sold to district cooling operators

Source: Dubai Municipality

Exhibit 28: Share of treated sewage effluent usage by application in 2017



WATER REUSE AND EFFICIENT IRRIGATION

3 ADOPTION OF EFFICIENCY MEASURES IN NEW LANDSCAPE PROJECTS

In addition to the implementation of revised irrigation standards for water quantity in all new developments since 2015 (see exhibit 29) and the application of a one-day-per-week switch-off programme in some communities during the summer, DM has started adopting equal amounts of hardscape elements (e.g., gravel, glass) and greenery in all new landscape projects. The new landscape project on Al Khail Road, which will be complete in June of 2018, will feature hardscape elements in 60% of the landscape area (see exhibit 30.A). Additionally, where suitable, DM has begun opting for local species that have very low water requirements, as can be seen around the Qudra lake area (see exhibit 30.B).

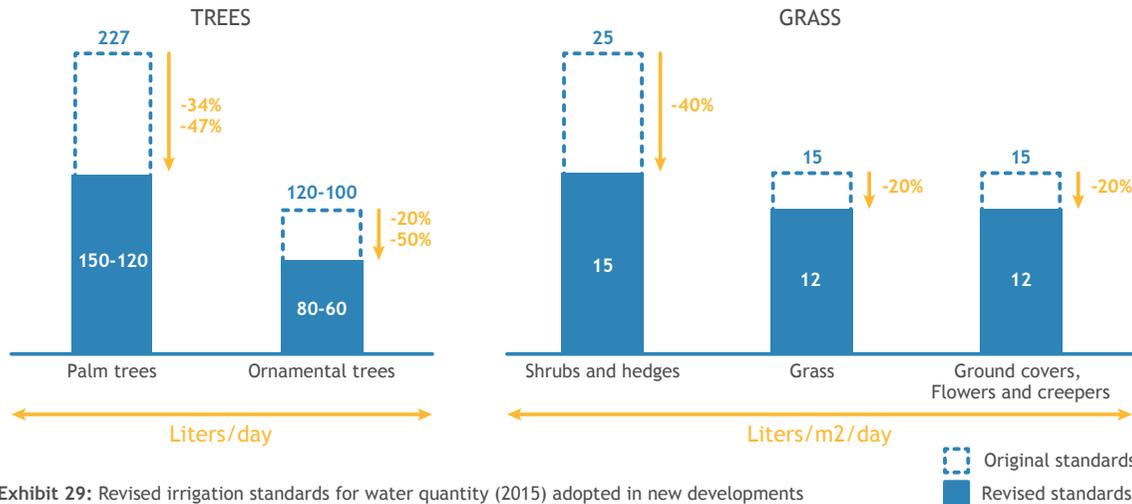


Exhibit 29: Revised irrigation standards for water quantity (2015) adopted in new developments



Al Khail Road landscape project, between Business Bay Bridge and Za'abeel Interchange 1:

Hardscape elements will cover over 60% of the landscape area. This contributes to lower water consumption, while it fulfills beautification goals. Additionally, revised irrigation standards for water quantity are applied to the other 40% of the landscape.

Solar panels will be used as a source of renewable energy for landscape lighting at night.



Al Qudra lake area:

The selected trees in the area, e.g., Ziziphus Spina (Jujuba), are particularly suitable to the local climate and draught.

These types of trees require 30 - 40 liters/day compared to ornamental trees that require 60 - 80 liters/day

Exhibit 30: A. Example of hardscape measure adoption in new Dubai Municipality landscape projects B. Example of local specie adoption in public greenery



WATER REUSE AND EFFICIENT IRRIGATION

PRIORITY AREAS

1

MAXIMISING THE POTENTIAL OF TREATED SEWAGE EFFLUENT WATER SUPPLY

Although potential savings from TSE measures could be massive, a few challenges need to be overcome to translate these savings into higher desalinated water savings.

With the exception of a few months of summer when desalinated water consumption drops since many residents are out of the country, TSE supply exceeds demand. Imbalance in supply and demand also occurs during the same day, with insufficient supply in the morning and excess supply during the remainder of the day.

To increase demand for TSE and optimise its usage, DM is working on expanding the network needs (e.g., towards DC plants), and at the same time, stabilising TSE supply.



Recipe for less water usage in irrigation: efficient and smart irrigation technology, local species, and hardscape elements

2

MINIMIZING IRRIGATION CONSUMPTION IN LANDSCAPES

Availability of TSE per capita is expected to decrease as demand for desalinated water will reduce following the implementation of DSM measures, whereas irrigation needs are expected to increase in response to DM's 2030 greenery expansion plan. In fact, DM targets to increase green spaces as a percentage of total constructed areas in developed urban areas from 21% in 2011 to 25% by 2025.

For this reason, it is important to improve irrigation efficiency in DM and non-DM landscapes. This can be done by enforcing efficient irrigation technology, hardscape elements, and local species adoption in new projects, as well as financing irrigation retrofits in existing landscapes. Given the current low price of TSE, there is a limited business case for DM to execute irrigation retrofits. However, benefits are much larger from the perspective of the entire emirate; TSE savings would displace equal quantities of desalinated water.

3

ADOPTING AN INTEGRATED WATER RESOURCE MANAGEMENT APPROACH

Addressing the above-mentioned challenges requires an integrated approach that looks at reducing demand for the variety of TSE uses and at maximising and stabilising supply. This is why DM is currently collaborating with the Dubai Supreme Council of Energy with endorsement from the Executive Council to develop a comprehensive strategy in the aim of achieving maximum overall cycle efficiency for all water uses in Dubai.





DSM PROGRAMME 6:
**OUTDOOR
LIGHTING**

PROGRAMME SCOPE

Adopt high efficiency lighting in roads and other public spaces in Dubai, both in new installations and retrofits of existing assets. Implement efficiency measures such as dimming and partial switch-off.



BASSEL SAAD

Director of Roads and Facilities
Maintenance Department,
Roads and Transport Authority
www.rta.ae

PROGRAMME OWNER

هيئة الطرق والمواصلات
ROADS & TRANSPORT AUTHORITY

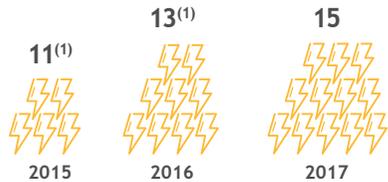


بلدية دبي
DUBAI MUNICIPALITY





PROGRAMME SAVINGS



Electricity Savings (GWh)

PROGRAMME INTRODUCTION

The effectiveness of LED (light-emitting diode) technology is proven by a number of extensive applications worldwide. The Roads and Transport Authority (RTA) and Dubai Municipality (DM) have also run pilot projects to assess its suitability in the environmental conditions of Dubai and the strict safety requirements of its roads. LED is now the technology of choice for new roads in Dubai, and a retrofit programme has been initiated, by both RTA and DM, to replace old lighting assets with LED or other high efficiency technologies. The programme targets 75% penetration of highly-efficient street lights in Dubai by 2030.

In the meantime, RTA has implemented measures to minimise the consumption of Dubai's existing conventional street lighting assets. In 2011, operating hours at dawn and sunset were reduced by a total of 20 minutes per day (10-10 initiative), and in 2013 a switch-off programme was implemented for every second light in designated residential areas (one-on one-off activation). Today, penetration of the switch-off measure has reached 100%. DM is also adopting switch-off measures in the public facilities they manage.

(1) 2015 and 2016 savings were readjusted (in comparison to 2016 report) due to updated calculation by RTA and for the purpose of comparing them with 2017 savings

OPERATIONAL DASHBOARD



Penetration of efficient lights out of total RTA and DM lighting assets



Switch-off penetration in designated residential streets

Legend:
■ 2015
■ 2016
■ 2017





OUTDOOR
LIGHTING

MAIN ACHIEVEMENTS

1 ENERGY EFFICIENT STREET
LIGHTING PROJECTS IN DUBAI

Initial LED installations have been successfully completed in new roads, for example in the residential streets of Barsha South 1 and 2, which have provided substantial energy savings and outstanding quality standards. Meanwhile, RTA has examined the feasibility of retrofitting its existing lighting stock and the application of LED to large roads. Today, LED lights represent 3% of RTA's total lighting assets.

In 2017, RTA completed the first pilot LED retrofit project with the replacement of 1,100 lights in the internal and collector roads of Al Rashidiya and Nad Shamma (see exhibit 31). As for LED application to main roads, lighting on the Sheikh Zayed Road Bridge over the Dubai Water Canal is an example of initial testing and shows benefits on multiple dimensions: energy efficiency, quality, community service, and landscape beautification.



Total LED Fittings: 1,105 pcs. | 44 W: 439 pcs. | 84 W: 666 pcs.

Technology	Conventional	LED	Expected Annual Savings
Annual Consumption (kWh)	683,197	333,332	349,865 (excluding switch off/ dimming)
Annual Energy Cost (AED)	259,615	126,666	132,949

Exhibit 31: Highlights of the LED retrofit pilot project in Al Rashidiya and Nad Shamma





**OUTDOOR
LIGHTING**

MAIN ACHIEVEMENTS

2 SMART DUBAI AND DEMAND SIDE MANAGEMENT OBJECTIVES ALIGNED IN STREET LIGHTING PROJECTS

Connected streets are at the core of smart cities. Each light pole can be powered, connected, and located, and hence used to receive and send information across the city. Recognising the potential of street lighting assets beyond lighting and energy efficiency, RTA has aligned Smart Dubai with Demand Side Management (DSM) objectives in its efficient outdoor lighting programme.

Smart applications will facilitate maintenance and operation of lighting assets (i.e., direct defect detection removes the need for patrolling), and help better serve the residents of Dubai by improving road safety and quality and by offering additional services through the lighting poles. Examples of potential services can be seen in the Dubai Water Canal boardwalk and footbridges, where street light poles provide pedestrians with WiFi, phone charging outlets and other interactive features.

In addition, smart applications can further improve energy efficiency thanks to enhanced controls. Complementing LED with controlled dimming can increase energy savings from LED retrofits and new installations while contributing to a better perception of energy efficiency measures in comparison with the currently adopted one-on one-off initiative.

3 ENERGY EFFICIENCY OUTDOOR LIGHTING PROGRAMME IN DUBAI MUNICIPALITY'S PARKS AND PUBLIC FACILITIES

DM is undergoing an energy efficiency transformation for outdoor lights in public parks and facilities. The transformation consists of 100% adoption of LED in new projects partly in combination with solar energy supply, progressive replacement of existing conventional lamps with LED, and reduction in operating hours (*see exhibit 32*).

Since 2012, over 10,000 LED lights have been installed across Dubai parks; 4,000 in new projects and 6,000 through the retrofit of conventional lights. In addition, operating hours have been reduced to a maximum of 6 hours per night, with switch-off after 12 am.

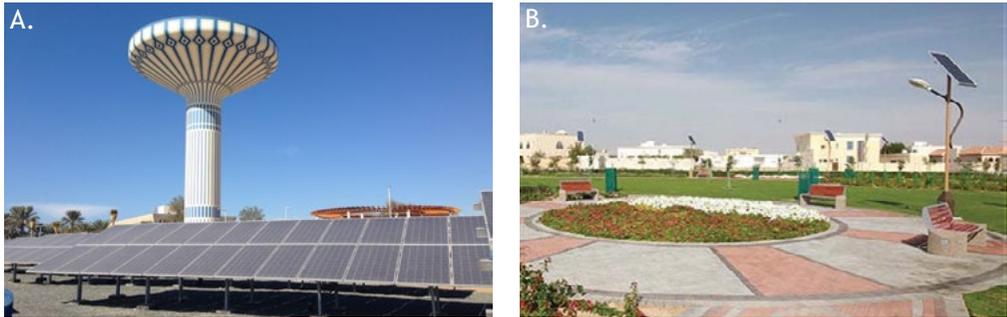


Exhibit 32: Dubai Municipality outdoor lighting projects
A. Al Khazzan Park, the first zero-energy park in Dubai
B. Solar-LED lighting systems in Nad Al Sheba Park, Dubai





**OUTDOOR
LIGHTING**

PRIORITY AREAS

**1 EXPANDING RETROFIT
PROJECTS IN ROADS**

RTA has developed a Smart and Efficient Outdoor Lighting Strategy defining a 15 year implementation roadmap for the installation of LED and other efficient lighting technologies in new roads, and more importantly in existing roads through retrofit projects. As per the strategy, the programme is expected to reduce electricity consumption of street lights in Dubai by 62%. RTA has also developed standards accompanying the roadmap to ensure road safety and quality while maintaining optimal efficiency.

**2 EXPANDING THE PROGRAMME TO
FREE ZONES AND PRIVATE DEVELOPMENTS**

A priority for the next few years is to better understand the current situation and plans for efficient outdoor lighting in free zones and private developments, and enforce collaboration with free zone authorities and private developers in the aim of expanding DSM efforts in these areas.

DEEP DIVE ON DSM PROGRAMMES AND INITIATIVES



DID YOU KNOW?

**END USER
BENEFITS OF
SMART STREET
LIGHTS**



- 1 HIGHER ENERGY EFFICIENCY**
- 2 LOWER MAINTANANCE COST**
- 3 ADDITIONAL SERVICES FOR PEDESTRIANS THROUGH THE POLES (E.G. Wifi coverage across the city)**
- 4 IMPROVED DRIVER EXPERIENCE THROUGH TRAFFIC AND PARKING MANAGEMENT**
- 5 IMPROVED RESIDENT SAFETY THROUGH PUBLIC CAMERAS**
- 6 BETTER WEATHER AND POLLUTION MONITORING**



DSM PROGRAMME 7: TARIFF RATES

PROGRAMME OWNER

هيئة كهرباء ومياه دبي
Dubai Electricity & Water Authority



PROGRAMME SCOPE

Adjust electricity and water tariff rates in Dubai to be cost-effective, ensure economic efficiency and align ratepayer with Demand Side Management (DSM) objectives.



YUSEF JEBRIL

Executive Vice President,
Power and Water Planning,
Dubai Electricity and Water Authority

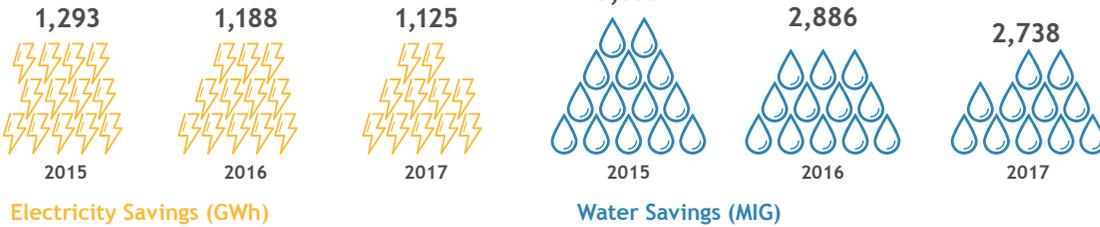
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TARIFF RATES

PROGRAMME SAVINGS

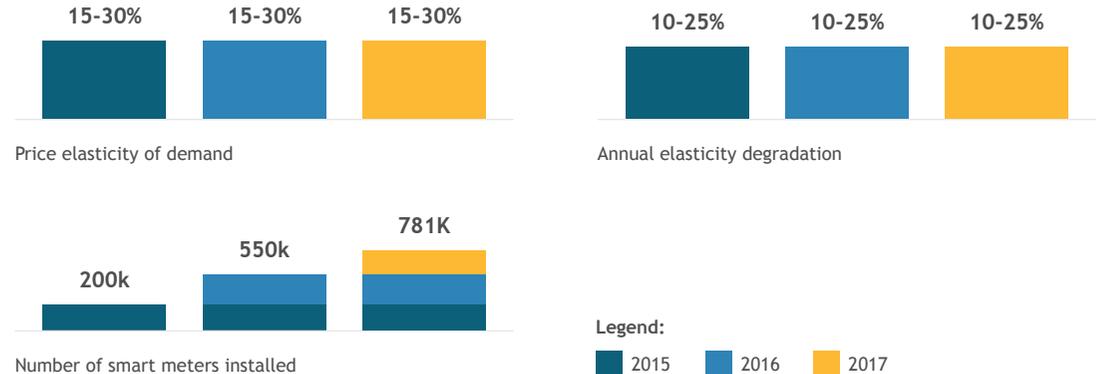


PROGRAMME INTRODUCTION

Price signalling is a key driver to induce energy efficient behaviours from customers. The tariff currently in place is designed in an inclining slab structure, which moves consumers to a higher tariff slab as their consumption rises.

The latest Dubai Electricity and Water Authority (DEWA) tariff review was in 2011. The increase in tariff resulted in 4% to 5% reduction in consumption of electricity and water, respectively, in the first two years of implementation, with decreasing impact over time. The Tariff Rates Programme kicked off the DSM Strategy 2030, being the major contributor to savings in the first years of strategy implementation.

OPERATIONAL DASHBOARD



Legend:
■ 2015 ■ 2016 ■ 2017





TARIFF RATES

MAIN ACHIEVEMENTS AND PRIORITY AREAS

1 MAINTAINING THE IMPACT OF THE 2011 TARIFF REVIEW

The electricity and water tariff structure is slab-based for all customer sectors, and higher consumption slabs correspond to higher tariffs. The 2011 tariff increase to the slab-based pricing has been effective in curbing demand trends towards more sustainable patterns (see exhibit 33).

Pricing is a signalling tool that is often used to induce energy efficient behaviours from customers and promote their collaboration in optimizing consumption. This ultimately results in avoided capital investments in new generation capacity and reduced consumption of fossil fuels by conventional generation units, on which Dubai's energy supply still depends strongly.

The addition of a fuel surcharge component in the tariff structure, which varies based on the actual fuel cost supplied to DEWA's generation plants, allows for more transparency with consumers on drivers of price changes.

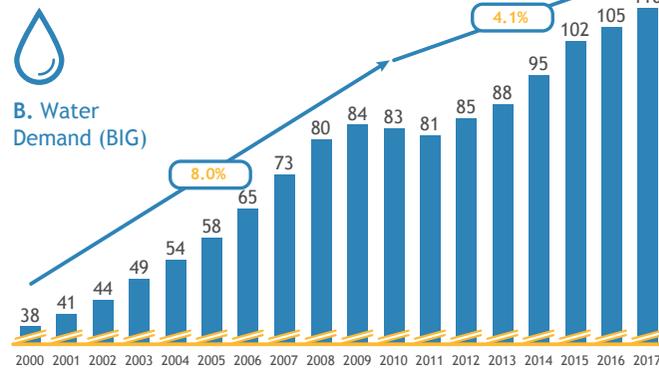
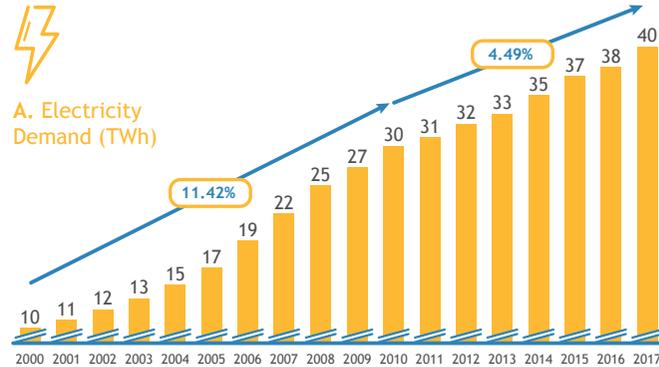


Exhibit 33: Electricity and water demand trends in Dubai, before and after the 2011 tariff review

NOTES Total consumption is at end-user level and excludes power stations and desalination auxiliaries, as well as losses in the transmission and distribution networks.

As any other price signal, the impact of the 2011 tariff review is diminishing over time (see exhibit 34). To sustain changes until the next tariff review, DEWA is investing significant resources in awareness initiatives, (e.g., Ideal Home, Neighbourhood, and Green Summer Campaigns targeted at the residential sector).

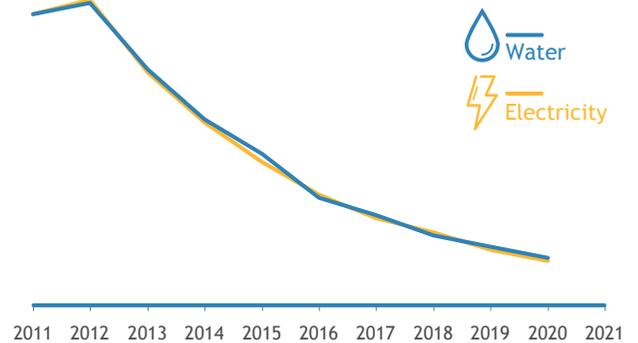


Exhibit 34: Degradation of 2011 tariff review impact on electricity and water savings





TARIFF RATES

2 REDUCING THE PEAK LOAD

In addition to overall consumption, another important factor affecting electricity generation infrastructure and cost is the electricity load profile, since peak demand defines generation capacity requirements and therefore capital expenditure.

Due to high variability of cooling load between the summer and winter seasons, the annual load swing is about 70%. The daily load profile in Dubai is characterised by three periods. During the summer, which is the high season, peak periods occur during the day and in the evening, while the valley period occurs late at night and in the early morning (see exhibit 35).

Through its combination of programmes, the DSM Strategy helps smooth down the load profile. For example, an increase in solar generation from Shams Dubai will support abatement of the day-time peak, while the Outdoor Lighting Programme and ESMA standards (e.g. for indoor lighting) can help reduce the evening-time peak.

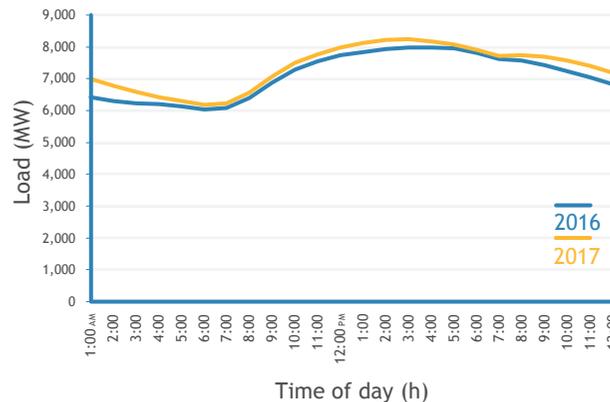


Exhibit 35: Dubai peak day load profile, 2016 and 2017

3 MODERNISING THE GRID

DEWA developed a Smart Grid Strategy for modernising the grid (see exhibit 36). By the end of 2017, 48% of all DEWA meters were replaced by smart meters. Adopting smart meters allows the utility to monitor and supervise customers' consumption and the quality of service provided through a system fully integrated with the Customer Happiness Department. Today, smart meters are used for remote meter reading and leakage detection, for monitoring generation and consumption from solar rooftop (PV) systems, and for identifying customers' consumption profile and running data analytics. In the future, smart meters can be leveraged to raise consumer awareness and induce behavioural change for reduced consumption.

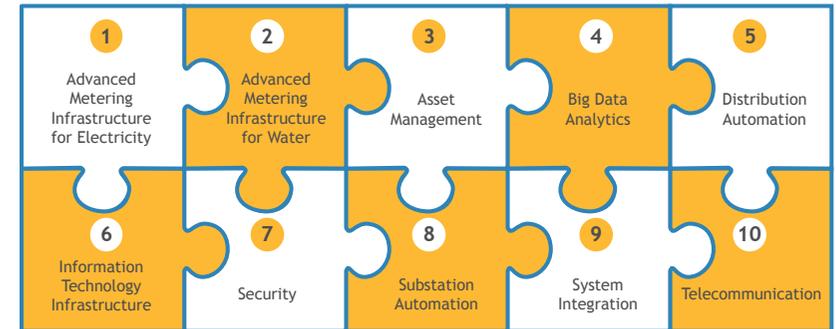


Exhibit 36: DEWA's Smart Grid Strategy with its ten programmes





DSM PROGRAMME 8:
**SHAMS
DUBAI**

PROGRAMME OWNER

هيئة كهرباء ومياه دبي
Dubai Electricity & Water Authority



الاتحاد
Etihad
لخدمات الطاقة Energy Services

PROGRAMME SCOPE

Encourage building and household owners in Dubai to install solar photovoltaic (PV) systems on their rooftop and connect them to Dubai Electricity and Water (DEWA) grid; and as a result, reduce their electricity bills and total demand on the grid.



WALEED SALMAN

Executive Vice President,
Business Development and Excellence,
Dubai Electricity and Water Authority

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PROGRAMME SAVINGS



Electricity Savings (GWh)

PROGRAMME INTRODUCTION

Shams Dubai supports the vision of His Highness Sheikh Mohammed Bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, to have a solar PV system on every rooftop in Dubai by 2030.

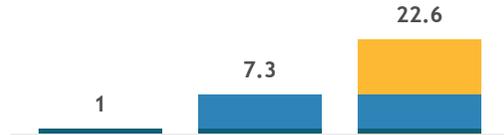
Shams Dubai is the first comprehensive framework for solar rooftop in the GCC (Gulf Cooperation Council). It implements the Executive Council Resolution No. 46 of 2014 and is built on a net-metering scheme. It allows consumers to generate electricity for their needs, connect their PV systems to the grid, and offset any excess generation from their electricity bills. Under this scheme, solar production can address the majority of a building's electricity need in some cases.

Along with net-metering, connection conditions on solar installation, which limit the allowable installed capacity to the electrical load of a customer's land plot and the consumption of the generated electricity to within the plot where it is generated, are the regulatory elements shaping the growth of the market.

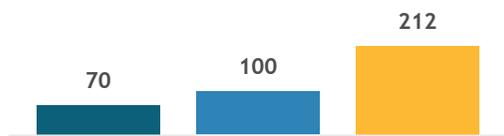
In addition to the regulatory framework, DEWA has defined technical specifications for PV systems, an accreditation scheme for contractors and consultants, and a permitting and connection process, which institutionalise programme quality. Today, more than 50 contractors are enrolled in the Shams Dubai Programme.

In parallel, towards the end of 2016, Etihad Energy Services (Etihad ES) launched Etihad Solar, a business unit focused on further stimulating the Solar Rooftop market.

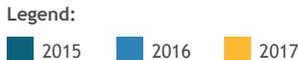
OPERATIONAL DASHBOARD



Cumulative connected solar rooftop capacity (MWp)



Pipeline of solar rooftop projects (MWp)





MAIN ACHIEVEMENTS

1 PROJECTS OF REMARKABLE SIZE IN A RAPIDLY GROWING MARKET

Solar Rooftop is a fast expanding market. In 2017, the connected solar rooftop capacity has tripled. In fact, the year was characterised by the connection of a few very large projects, some of which were sponsored by DEWA while others by private customers (see exhibit 37). DEWA projects notably included the 3 MWp installation on 640 villas in Hatta and 1 MWp installation in Dubai World Trade Center (DWTC). As for solar rooftop projects in the private sector, an example is the 1.1 MWp installation by RSA Global with financing from SirajPower.

The pipeline for 2018 is very promising. Additional solar rooftop capacity planned to be connected in 2018 is expected to be double the cumulative capacity so far connected. Studies conducted by leading industry players looking at sheer rooftop surface area where solar rooftop could be economically deployed, confirm the long-term growth potential of Shams Dubai.

A. Government project: Hatta, largest residential solar rooftop project



- Capacity: 3 MWp
- Connection date: January 2018
- Location: 640 villas and 2 government buildings in Hatta
- Financed by: DEWA, as a corporate social responsibility project under Hatta's comprehensive development plan, which was launched by His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai
- Executed by: Etihad ES and three enrolled solar contractors, Al Mostajed Technologies, Alsa Solar Systems and Dubai Carbon Center of Excellence
- Savings: 4.5 GWh/year

B. Private project: First solar rooftop project in Dubai South



- Capacity: 1.1 MWp that covers 90% of the electricity demand of the facility
- Connection date: November 2017
- Location: RSA Global, Dubai Logistic City
- Financed by: SirajPower through a 15 years lease agreement
- Executed by: SirajPower

Exhibit 37: Overview of large projects connected in 2017

It is important to understand the two business models in the market: direct ownership and third party ownership. In the direct ownership model, the customer buys and maintains ownership of the solar PV system; in the third party ownership model or solar leasing agreement, the customer pays a rental fee to a solar financing company (SFC) that installs a PV system on the customer's rooftop and remains the owner of the system during a lease agreement period (15 - 20 years).

DEEP DIVE ON DSM PROGRAMMES AND INITIATIVES

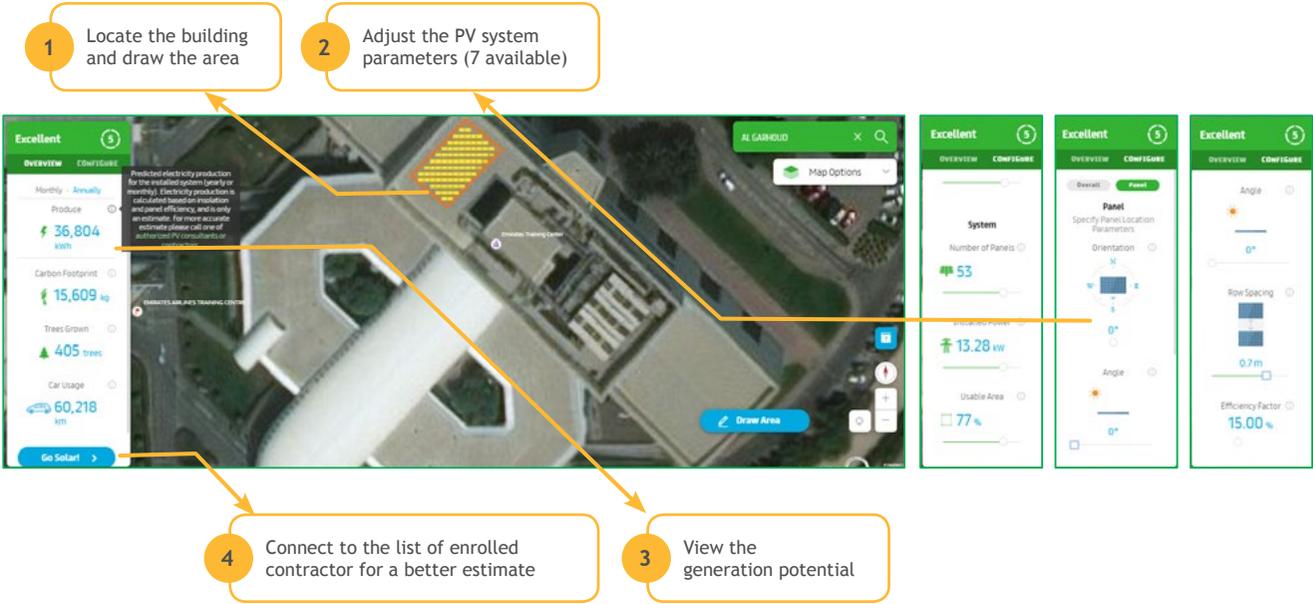




2 ENFORCED MARKET ENABLERS AND BUILDING CAPABILITIES

DEWA has worked on a number of initiatives in 2017 to promote Shams Dubai. Firstly, DEWA streamlined the end-to-end permitting and connection process. The process is now fully automated; submission of documents for No Objection Certificate and design approval, placement of requests for inspection, and payment of connection charges can be made online. In parallel to process automation, the building capabilities of local market players (utility, developers, and contractors) has contributed to a shorter lead time for permitting and connection.

In addition, DEWA has developed an online calculator accessible to the general public that enables customers to get a preliminary estimate of their generation potential (see exhibit 38). Increasing awareness levels on the benefits of solar rooftop and the available options in the market, as well as empowering customers to make educated decisions, are key to the success of the programme.



Link to calculator: www.dewa.gov.ae/en/customer/innovation/smart-initiatives/solar-calc

Exhibit 38: Functionalities of the Shams Dubai Calculator developed by Dubai Electricity and Water Authority





PRIORITY AREAS

1 GOVERNING BY EXAMPLE

Dubai government prides itself in governing by example, a principle that has been applied to the implementation of several Demand Side Management programmes, previously programme one, and lately programmes two and four. As for Shams Dubai, DEWA has been driving the programme through large solar rooftop projects. In fact, in addition to the already connected project, DEWA has announced a 60 MWp solar PV installation on over ten of its water reservoirs. There has also been a number of installations on other government entity buildings. That being said, continuous contribution by all government entities through the solar transformation of their facilities will help strengthen the solar rooftop market in Dubai.

2 SUPPORTING COMMERCIAL AND INDUSTRIAL PROJECTS

Another programme priority is to support private commercial and industrial businesses, which, beyond government sponsored projects, are a driving force for solar rooftop adoption owing to their high solar generation potential (installations > 500kWp).

Since capital required to own a PV system is high and would require diverting funds from core business investment opportunities, the leasing agreement model is attractive to private sector customers. The business case for customers in solar leasing agreements is directly proportional to the rental fee offered by the SFC in the agreement; the lower the rental fee, the higher the saving versus the DEWA tariff alternatively paid (which in the case of high consuming businesses is the highest customer slab for commercial and industrial customers). Hence, solar rooftop adoption in the private sector can be accelerated if the saving versus the DEWA tariff is noteworthy.

To increase this saving, the key cost to address is the cost to finance the project, and this can be done by reducing the cash flow risks associated with a project, i.e., risk of default on payment or risk of a customer abandoning the building during the agreement period.

Saving versus the DEWA tariff offered by private SFCs has increased from as low as 10% to as high as 30% by end of 2017, as a result of financial engineering and well drafted contracts. However, legal agreements still experience significant scrutiny by customers, extending the project sales cycle.

3 CREATING A BUSINESS CASE FOR THE RESIDENTIAL AND SME SECTORS

Today, residential and SME sectors suffer from a low business case and a lack of third party funding in the form of micro-project financing. An action item for the coming years is to streamline the business model and develop mechanisms to enhance the business case for these sectors, i.e., reduce the cost per kilowatt peak of small scale installations (< 50 kWp). An example of potential mechanisms was adopted in Hatta, where small scale solar PV systems (5 kWp) for 640 villas were purchased in bulk, thus reducing the overall cost of the micro-installations.



SPECIAL PROJECT 1:
**DSM ENERGY
INTENSITY MAPPING**

PROJECT INTRODUCTION AND OBJECTIVES

Energy Intensity Mapping is a platform launched by the DSCE to allow the DSM programme manager to monitor electricity and water consumption of buildings across Dubai and channel that information through to the different DSM programme owners or other stakeholders to enable policy making, implementation support and awareness improvement across Dubai and for all building typologies.

The mapping platform displays energy use intensity, which is the annual energy consumption per unit area (kWh/m^2 or IG/m^2), and hence provides a normalised energy consumption index for each building. As energy consumption per account is frequently updated, the platform outlines (to a relatively high definition) consumption patterns of different building typologies. It can help target high energy consumers, whether on a consumer segment, community, or building level, and can help determine the applicability and feasibility of energy conservation measures e.g., energy retrofit projects, awareness programmes, solar rooftop installations, district cooling (DC) connections, and efficient irrigation measures. Ultimately, the tool can guide policy design to attain Demand Side Management (DSM) targets.





OVERVIEW OF THE PLATFORM

The platform allows a bird's-eye view of Dubai, showing buildings or communities in different colours depending on their energy use intensity. Zooming out displays, on a macro level, the energy intensity of Dubai's communities, and zooming in displays, on a micro level, buildings with their energy use intensity (see exhibit 39). In addition, the mapping platform allows to filter buildings with installed solar photovoltaic (PV) system, those compliant with Dubai Green Building Regulations and Specifications (DGBRS) 2010, those connected to district cooling, or those that have been retrofitted.

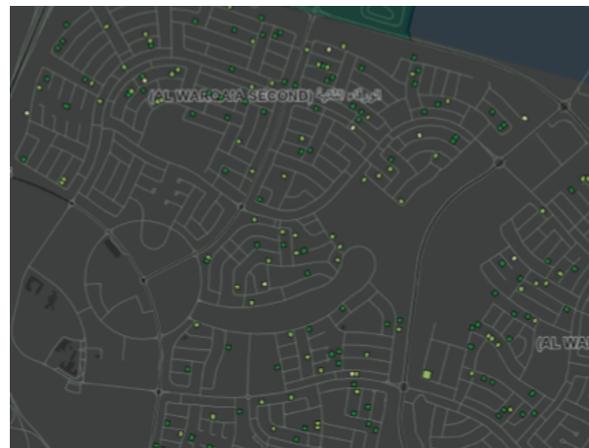
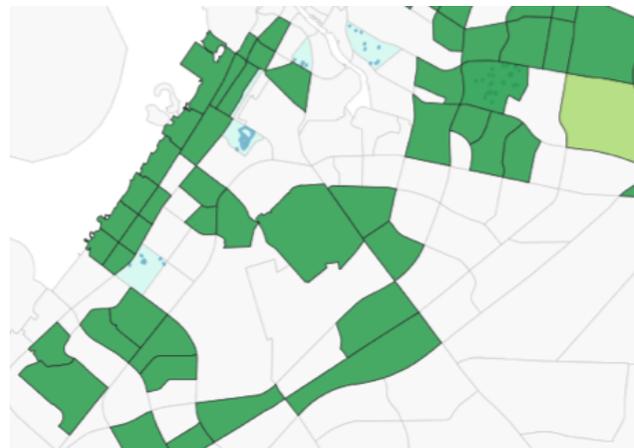


Exhibit 39: DSM Energy Intensity Mapping platform

- A. A macro view showing average energy intensity of different communities in Dubai (Red: high intensity, dark green: moderate intensity and light: green low intensity)
- B. A micro view showing energy intensity of multiple buildings in one community

PROJECT ACHIEVEMENTS AND PRIORITY AREAS

TAQATI has uploaded consumption and building area data for 5,000 buildings; which constitute the first phase of the programme.

The second phase of the project consists of extracting value from the existing platform and data and, at the same time, uploading data for 50,000 buildings. When this phase is complete, the programme will be ready to be used for monitoring progress of the different DSM programmes (e.g., Building Retrofits, District Cooling) and their impact on energy intensity at the city level. This scale up will require software upgrades and database expansion to allow for the automated ingestion of data.



SPECIAL PROJECT 2:
**GREEN PUBLIC PROCUREMENT FOR
ENERGY AND WATER EFFICIENCY**

PROJECT INTRODUCTION AND OBJECTIVES

Green procurement is a practise followed in organisations to procure at competitive prices products and services with reduced environmental impact: lower carbon emissions owing to their electricity and water efficiency, lower waste generation, and lower toxic emissions.

The Dubai Supreme Council of Energy (DSCE) has issued in November 2015, in line with Demand Side Management (DSM) strategy, guidelines for the implementation of the Green Public Procurement for Energy and Water Efficiency (GPPEWE) initiative for the implementation of green procurement practises within Dubai Government with a specific focus on electricity and water efficiency. The primary focus of the guidelines is to reduce direct electricity and water consumption, and the secondary focus is to reduce indirect consumption and emissions (upstream and downstream) of the product or service purchased, in line with the Greenhouse Gas Protocol (GHGP). The guidelines outline the scope, governance, and roadmap for implementing GPPEWE within the procurement processes of government entities.





GREEN PUBLIC PROCUREMENT FOR ENERGY AND WATER EFFICIENCY

MAIN ACHIEVEMENTS AND PRIORITY AREAS

There has been some considerable progress since the issuance of the directive.

- **Governance:** A green procurement committee was formed and meets when required, green procurement officers were assigned across entities, and Dubai Electricity and Water Authority (DEWA) was appointed as the green procurement champion.
- **GPPEWE scope:** A baseline study was carried out to identify product categories with the highest electricity and water saving potential (largest share of energy consumption and purchase value) and the penetration of green purchases among these products. As a result of the study, GPPEWE penetration targets were set for the prioritised product categories.
- **GPPEWE criteria:** GPPEWE criteria are designed to be included in tender documents to ensure that products supplied comply with energy efficiency, toxic emission, and waste generation requirements. Through a collaborative effort between DSCE member entities and the support of DEWA and TAQATI, GPPEWE criteria were developed for the indoor lighting, electric motor, unit air conditioning equipment, IT equipment, refrigerating appliances, indoor water fixtures and outdoor irrigation equipment.
- **GPPEWE application:** In 2017, the pilot application of the criteria for indoor lighting was successfully carried out by DSCE member entities.

The next step is to test the application of the green criteria developed for other product categories. As per the roadmap defined in the guideline, once the green criteria are successfully tested in DSCE member entities, they will be rolled out to other government entities.



Exhibit 40: Guidelines for the implementation of Green Public Procurement for Energy and Water Efficiency in Dubai, general criteria and criteria for indoor lighting

Link to publication: <http://taqati.ae/green-public-procurement-roll-out-workshop/>



DSM AWARENESS IMPROVEMENT



Awareness improvement is a key enabler to the achievement of the Demand Side Management (DSM) targets. Behavioural changes can only happen when people and organisations are aware of their energy consumption and of measures and practises they can adopt to reduce their consumption.





**DSM AWARENESS
IMPROVEMENT**

MAIN ACHIEVEMENTS

**1 DEVELOPMENT OF THE DSM INTEGRATED
AWARENESS STRATEGY 2022**

With the objective of ensuring integration of efforts and eliminating duplications, the DSM Integrated Awareness Strategy (IAS) 2022 was developed as a joint and collaborative effort between all DSM programme owners under the guidance and direction of a dedicated committee, the DSM Integrated Outreach and Awareness Committee (IOAC) and led by TAQATI. The committee was established in November 2016 and is chaired by the Dubai Supreme Council of Energy and vice chaired by TAQATI. It includes members from all the DSM programme owner entities, namely Dubai Electricity and Water Authority (DEWA), Dubai Municipality (DM), the Roads and Transport Authority, the Regulatory and Supervisory Bureau for Water and Electricity in Dubai (RSB), Etihad Energy Services Company (Etihad ES), and Emirates Authority for Standardization and Metrology (EMSA).

The strategy covers all DSM programmes; it defines strategic objectives and measurable annual targets for each programme (from 2018 to 2022), with a focus on general awareness and willingness across key target segments (see exhibit 41).

DEEP DIVE ON DSM PROGRAMMES AND INITIATIVES



Exhibit 41: Illustrative strategic objectives of the Integrated Awareness Strategy 2022



DSM AWARENESS IMPROVEMENT

The strategy is implemented through the deployment of initiatives across five categories (see exhibit 42).

Category	Main Sub-categories (non-exhaustive)
Networking Events and Activities	<ul style="list-style-type: none"> • Conferences • Workshops • Webinars
Awards and Recognition	<ul style="list-style-type: none"> • Awards and recognition
Technical Resources	<ul style="list-style-type: none"> • Sector-specific guidebooks • Tools and calculators • Training material
Marketing and Outreach	<ul style="list-style-type: none"> • Apps • In-store promotions • Interactive displays • Brochures, leaflets and banners
Public Awareness Campaign	<ul style="list-style-type: none"> • Digital media (social media, websites) • Traditional media (print, TV)

Exhibit 42: Integrated Awareness Strategy 2022 awareness initiative categories

A policy statement for the DSM IAS 2022 implementation was signed by the IOAC members on behalf of the DSM programme owners, highlighting their commitment to jointly execute the strategy and its targets. In addition, operational plans for 2018 have been developed for all DSM programmes to effectively implement IAS 2022, and implementation support was assigned to TAQATI to ensure annual awareness targets are met by each programme owner.

2 EXECUTION OF SECTOR-SPECIFIC AWARENESS INITIATIVES

Residential: Home Energy Advice Programme

The Home Energy Advice Programme aims at tackling residential consumption by providing residential consumers with tailored advice on how to reduce energy consumption in their homes.

In 2017, a pilot was conducted by TAQATI as part of DEWA's Ideal Home campaign. The pilot included visits to 60 homes in Dubai. Information on the energy efficiency of appliances used and usage behaviour was collected during the visits. Basic technical tests, such as water flow testing for indoor water fixtures, were also conducted. Following the visits, personalised home energy conservation reports were shared with the home owners. The reports highlighted potential electricity and water savings that can be attained if a set of customised energy conservation measures or tips included in the report are applied (see exhibit 43).

The Home Energy Advice Programme is the first of its kind in the UAE and has received positive feedback from home owners showing their interest in learning more about energy efficiency home improvements and willingness to conserve energy and generate savings on their utility bills.

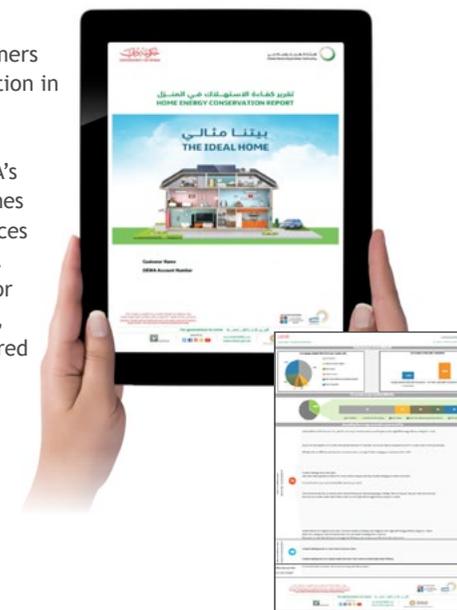


Exhibit 43: Extract of the personalised home energy conservation report





DSM AWARENESS IMPROVEMENT

Education:

Energy Efficiency Guidebook for Educational Institutions

As part of the School Conservation Award, TAQATI supported DEWA in developing the “Energy Efficiency Guidebook for Educational Institutions” (see exhibit 44), a comprehensive guidebook that provides step-by-step guidance on the basics needed for an educational institution to develop a constructive energy conservation plan and achieve noticeable savings on electricity and water consumption.



Exhibit 44: Energy Efficiency Guidebook
for Educational Institutions

Link to guidebook: <https://www.dewa.gov.ae/en/customer/sustainability/awards-and-campaigns/downloadable-materials>

Industrial:

Energy Efficient Industries Panel and Green Industries Award Scheme

The industrial sector has witnessed strong growth over the last decade; it is currently the third largest contributor to Dubai’s GDP (gross domestic product) and accounts for 30% of greenhouse gas emissions in Dubai. With the Dubai Industrial Strategy, the sector is expected to continue its growth path, making it a key contributor to energy consumption.

As part of the “Future Manufacturing and Trade Summit” held on November 2017, TAQATI organised the panel for “Energy Efficient Industries in Dubai” alongside DEWA, Etihad ES, and Dubai Exports. The panel shed light on retrofitting and solar rooftop as energy efficiency measures relevant to the industrial sector and presented success stories. In addition, the panel introduced the upcoming Green Industries Award Scheme. The award scheme is led by Dubai Exports in collaboration with Etihad ES and TAQATI as technical partners, and aims at encouraging industrial facilities to implement energy efficiency measures. The first cycle of the award scheme is planned for 2018.

Hospitality:

Dubai Green Hotel Innovation Conference

Dubai is investing heavily in the hotel sector with 300 hotels in the pipeline to open before 2020, adding to approximately 700 hotels currently operating in Dubai. In addition, with plans to host 20 million tourists a year by 2020, it is becoming increasingly important to ensure hotels are operating efficiently and sustainably.

The DSM Strategy was included as a key feature in the Dubai Green Hotel Innovation conference of 2017, with DM, Etihad ES and TAQATI as key supporting partners. The conference included presentations and panel discussions to support hotels in understanding and adopting energy efficiency practises and solutions, namely “Demand Side Management Applications for Hotels” by TAQATI, building regulations and Al Sa’fat by DM, and building retrofits by Etihad ES.



**DSM AWARENESS
IMPROVEMENT**

PRIORITY AREAS

The DSM IAS 2022 will be fully activated in 2018. This includes new and existing programme-specific initiatives rolled out by individual DSM programme owners with the support of TAQATI, as well as a number of joint priority initiatives.

DEEP DIVE ON DSM PROGRAMMES AND INITIATIVES

**1 LAUNCHING AND ACTIVATING THE
INTEGRATED PUBLIC AWARENESS CAMPAIGN**

The DSM Public Awareness Campaign is the main initiative of the DSM IAS 2022 to create an energy-conscious society that conserves electricity and water as a way of life. The continuous campaign is a joint effort between all the DSM programme owners with the key objective of having one voice for energy efficiency to ensure consistency of messages and increase impact. It will provide Dubai’s community with a better understanding of energy efficiency, effective conservation measures as well as the associated financial, environment and societal benefits. The campaign will be launched with a unified tagline in the first half of 2018.

**2 CREATING A ONE-STOP ENERGY
EFFICIENCY AWARENESS WEBSITE**

A one-stop energy efficiency awareness website will be developed and rolled out in collaboration with all DSM programme owners. The website will target residential, government, commercial and industrial sectors and will include:

- Tips and conservation measures, highlighting the benefit of their application
- Guidebooks, such as energy management guidebooks, guides to buying efficient appliances and building an energy efficient home, etc.
- Interactive tools and calculators

**3 ROLLING-OUT THE HOME
ENERGY ADVICE PROGRAMME**

Following the successful pilot of the Home Energy Advice Programme in 2017, the programme will be integrated in 2018 into a mobile application to enable users to input details on the energy consuming components of their homes or offices in order to obtain personalised energy conservation reports. In addition, the programme is being considered for expansion into home inspections available to Dubai residents upon their request.



6

FUTURE OUTLOOK AND KEY PRIORITIES FOR THE NEXT THREE YEARS



Strategic priorities that support the scale-up of the Demand Side Management (DSM) programmes and address identified risks to achieving the DSM Strategy saving targets are defined and amended on an annual basis.

For the next three years (2018-2020), the main strategic priorities, enablers, and actions are the following:

- Ensure more extended implementation of green building regulations in free zones, possibly targeting code harmonisation across Dubai.
- Stimulate the market for water retrofit projects.
- Enact a regulatory framework for the district cooling market in Dubai and provide awareness support.
- Introduce additional measures to further increase consumer adoption of efficient appliances and support the Emirates Authority for Standardization and Metrology in the continuous review and update of standards, particularly for the highest consuming appliances.
- Define and activate a set of measures to allow savings in treated sewage effluent (TSE) from public irrigation and use saved water as a replacement for desalinated water in other applications, e.g., district cooling.
- Monitor and provide the necessary support to Shams Dubai towards its ambitious 2030 goal.
- Reinforce financing mechanisms in support of the Building Retrofits and Shams Dubai Programmes (specifically to penetrate residential and commercial sectors), and identify financing solutions for landscape irrigation retrofits.
- Implement stronger awareness measures, supported by an energy performance labelling scheme for new and existing buildings.
- Keep enhancing the main cross-cutting capabilities in support to DSM, including awareness, capacity building, financing, energy management, and measurement and evaluation.

These priorities feed into the development and execution of operational plans by programme owners for their DSM programmes.



7

ACKNOWLEDGEMENTS



We are grateful to the leaders, peers, and colleagues who have helped achieve the important targets of 2017. In particular, we express deep gratitude to DSCE Board Chairman and Members, DSM Executive Committee, Integrated Outreach and Awareness Strategy Committee members, executives and working groups from the entities listed below (in alphabetical order):

- Dubai Electricity and Water Authority
- Dubai Municipality
- Dubai Land Department
- Dubai Petroleum Establishment
- Dubai Supply Authority
- Emirates Authority for Standardization and Metrology
- Emirates National Oil Company
- Emirates Global Aluminium
- Emirates Green Building Council
- Empower
- Etihad Energy Services Company
- Regulatory and Supervisory Bureau for Water and Electricity in Dubai
- Roads and Transport Authority
- The Executive Council of Dubai
- The Dubai Free Zone Council and its member authorities
- Trakhees

A special recognition as key contributors to the information contained in this report goes to (in alphabetical order):

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Abdullah Al Hajri
Armando Dominioni
Noura Al Naqbi
Ramadan Abou El Fetouh
HE Saeed Mohammed Al Tayer
Shaher Eissa
Sultan Al Zaabi
Sunil Mirchandani
Waleed Salman
Yousef Jebri
- **Dubai Municipality**
HE Dawoud AlHajri
Fahed Al Awadhi
Fida Alhammadi
Mansour Rafie
Mohammed Alrayees
Saeed Safar
Salim Zid
Talib Julfar
- **Roads and Transport Authority**
Ali Abdul Kareem
Bassel Saad
Hala Almakt
Nazim Saeed
Odeh Odeh
Reji Mathew
- **Regulatory and Supervisory Bureau for Water and Electricity in Dubai**
Elie Matar
Graeme Sims
James Grinnell
Zaineb Al Amin
- **Etihad Energy Services Company**
Ali Al Jassim
Christos Mimikopoulos
Ibrahim Mohammad
Pradeep Singh
Michel Battikh
- **Emirates Authority for Standardization and Metrology**
HE Abdulla Al Maeeni
Essa Al Hashmi
Hana Al Kokhardi
Marco Intalan
- **Trakhees**
Abdulla Belhoul
P.R. Jagannathan
- **Emirates Green Building Council**
Saeed Al Abbar
- **Mohammed Bin Rashid Space Centre**
Shaikha Ahmad Al Falasi



8

LIST OF ABBREVIATIONS



AC	Air conditioner
AED	United Arab Emirates dirhams
BAU	Business as usual
BIG	Billion imperial gallons
CAGR	Compounded annual growth rate
CO ₂	Carbon dioxide
DC	District cooling
DEWA	Dubai Electricity and Water Authority
DGBRS	Dubai Green Building Regulations and Specifications
DIES	Dubai Integrated Energy Strategy
DM	Dubai Municipality
DPE	Dubai Petroleum Establishment
DSCE	Dubai Supreme Council of Energy
DSM	Demand Side Management
EESL	Energy Efficiency Standardization and Labelling

EGA	Emirates Global Aluminium
ENOC	Emirates National Oil Company
EPC	Energy performance contracting
ESCO	Energy service company
ESMA	Emirates Standardization and Metrology Authority
Etihad ES	Etihad Energy Services LLC
GCC	Gulf Cooperation Council
GCTS	Gulf Standardization Organization Conformity Tracking Symbol
GPPEWE	Green Public Procurement for Energy and Water Efficiency
GSO	Gulf Standardization Organization
GWh	Gigawatt hours
HE	His or Her Excellency
IAS	Integrated Awareness Strategy

IG	Imperial gallons
IOAC	Integrated Outreach Awareness Committee
JAFZA	Jebel Ali Free Zone Authority
kWh	Kilowatt hours
kWp	Kilowatt peak
LED	Light-emitting diode
m ²	Square metres
MBRSC	Mohammed Bin Rashid Space Centre
MEPS	Minimum Energy Performance Standards
MIG	Million imperial gallons
MSCFT	Million standard cubic feet
MTRh	Million ton hours of refrigeration
MW	Megawatt
MWh	Megawatt hours
MWp	Megawatt peak
N/A	Not applicable
nZEB	Nearly zero energy building

OEM	Original equipment manufacturer
PMO	Programme management office
PV	Photovoltaic
QR code	Quick Response code
RFID	Radio-frequency identification
RTA	Roads and Transport Authority
SFC	Solar financing company
SME	Small medium enterprise
STP	Sewage treatment plant
TR	Tons of refrigeration
TRC	Total resource cost
TSE	Treated sewage effluent
TWh	Terawatt hours
YoY	Year over year



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10 CONTACT INFORMATION



Publisher of the DSM Annual Report



المجلس الأعلى للطاقة
Supreme Council of Energy

Supreme Council of Energy
P.O. Box. 121555, Dubai,
United Arab Emirates
Tel: +971 4 3072034
Email: Info1@dubaisce.gov.ae

Editor and DSM Programme Manager



TAQATI
P.O. Box 37578, Dubai
United Arab Emirates
Tel: +971 4 322 0383
Email: info@taqati.ae

Editors

Aref Abou Zahr, Executive Director
Shadi Kadi, Program Management Director
Evita Moawad, Senior Analyst

Programme Owners



هيئة كهرباء ومياه دبي
Dubai Electricity & Water Authority

Dubai Electricity and Water Authority
P.O. Box 564, Dubai
United Arab Emirates
Tel: +971 4 601 9999
Email: customercare@dewa.gov.ae



Dubai Municipality
P.O. Box 67, Dubai
United Arab Emirates
Tel: +971 4 221 5555
Email: info@dm.gov.ae



هيئة الطرق والمواصلات
ROADS & TRANSPORT AUTHORITY

Roads and Transport Authority
P.O. Box 118899, Dubai
United Arab Emirates
Tel: +971 4 284 4444
Email: ASK@rta.ae



مكتب التنظيم والرقابة لقطاع الكهرباء و المياه
RSB FOR ELECTRICITY & WATER

Regulatory and Supervisory Bureau
for Water and Electricity in Dubai
P.O. Box 121555, Dubai
United Arab Emirates
Tel: + 971 4 322 9609
Email: info.rsb@rsbdubai.gov.ae



Etihad Energy Services
P.O. Box 37578, Dubai
United Arab Emirates
Tel: +971 4 322 0383
Email: etihad.info@etihadesco.com



Emirates Authority for
Standardization and Metrology
P.O. Box 48666, Dubai
United Arab Emirates
Tel: +971 600 565 554
Email: customercare@esma.gov.ae

المجلس الأعلى للطاقة Supreme Council of Energy



ABOUT THE DUBAI SUPREME COUNCIL OF ENERGY

The Dubai Supreme Council of Energy (DSCE) was formed in August 2009 under Law 19 of 2009, issued by His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE, and Ruler of Dubai.

His Highness Sheikh Ahmed bin Saeed Al Maktoum was appointed Chairman for the Council, His Excellency Saeed Mohammed Al Tayer as Vice Chairman, and His Excellency Ahmad Al Muhairbi as Secretary General.

The Council consists of the following members: the Director General of the Department of Petroleum Affairs, the President and Chief Executive Officer of DUBAL Holding, the Chief Executive Officer of Emirates National Oil Company and a single representative from the Dubai Supply Authority, Dubai Petroleum Establishment, Dubai Municipality, Dubai Nuclear Energy Committee and Roads and Transport Authority.

The Council has an Advisory Committee from competent and specialised workforce.

The new Governing body seeks to ensure that the Emirate's growing economy will have sustainable energy while preserving the environment. The Authority is developing alternative and renewable energy sources for the Emirate, while increasing energy efficiency to reduce demand.

Under the visionary guidance of His Highness Sheikh Mohammed bin Rashid Al Maktoum, the Dubai Integrated Energy Strategy 2030 was developed in 2010 and deployed in 2011 to set the strategic direction of Dubai towards securing sustainable supply of energy and enhancing demand efficiency (for electricity, water and transportation fuel).



ABOUT TAQATI | DUBAI ENERGY EFFICIENCY PROGRAMME

TAQATI is the dedicated Programme Management Office for Dubai's Demand Side Management (DSM) Strategy which targets a reduction in energy consumption by 30% by 2030. It was established by the Dubai Supreme Council of Energy (DSCE) under Etihad Energy Services Company to provide implementation support and guidance to all relevant stakeholders for the DSM Strategy.

With its eight distinct programmes, Dubai DSM 2030 resembles the single most integrated approach to energy efficiency globally. DSM Strategy 2030 is one of the three key pillars of the Dubai Integrated Energy Strategy (DIES) 2030, targeting 30% energy (electricity and water)

reduction by 2030 confirms Dubai's commitment to be one of the most sustainable cities in the world.

For more info on DIES 2030, DSM Strategy 2030 and TAQATI, please visit TAQATI's website at www.taqati.ae or email: info@taqati.ae

