

# Heading Towards Energy Efficiency in the UAE

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## ABSTRACT

The world's demand for energy is expected to double by 2050. A 50% reduction in atmospheric carbon emissions is needed by 2050 to mitigate the potential effects of climate change. Buildings contribute to our energy dilemma both globally and locally in the United Arab Emirates (UAE). Buildings lead electric consumption in the UAE emirates of Abu Dhabi and Dubai accounting for over 80% of the total annual electricity consumption.

The market analysis shows that 1 billion AED (United Arab Emirates dirham) in savings could be achieved with a mere 10% energy consumption reduction in the buildings sector; this would generate a market potential of over 2 billion AED for all the stakeholders involved in the energy efficiency services and solutions industry by targeting quick return energy efficiency measures. Energy efficiency is a strategy with three essential elements that are needed to be successful: focus, measurements and accountability.

This purpose of this article is to discuss how monitoring based commissioning is a viable methodology for achieving quick results by helping to verify energy savings. With commissioning, risks from other energy efficiency initiatives can be reduced.

There are considerable challenges when using energy savings performance contracting (ESPC). These take the form of performance guarantees, financing schemes, legal frameworks, documenting savings and verifying performance. Financing options can be a bottleneck limiting the success of the energy services company (ESCO) business model. Other expenses include high transaction costs, insurance, guarantee and performance bonds which typically amount to 12% to 16% of a project's revenue.

## INTRODUCTION

Today, the world faces a global energy dilemma with two major challenges: 1) satisfying the ever-surging global demand for energy; and 2) the increased global pressure to lower carbon emissions while adopting more efficient practices.

The world's energy demand is expected to double by 2050. Both the Intergovernmental Panel on Climate Change (IPCC) and International Energy Agency (IEA) have called for carbon emissions to be reduced by 50% to mitigate the effects of drastic climate changes.

Energy efficiency is often referred to as "the fifth fuel," the others being coal, petroleum, nuclear power and renewable energy. Energy efficiency is defined as consuming less energy while performing the same function or delivering the same output; it is an important way to address the increasing demand for energy. In practice, energy efficiency can be achieved by various means. All yield reduced energy consumption without compromising operational needs, quality of life and comfort levels. The world's evolution towards greater energy efficiency is an important goal.

## RESOLUTION IN FIGURES

A report released in 2015 by the Abu Dhabi Statistics Center indicates that domestic, commercial and governmental buildings in Abu Dhabi account for about 84% of the total electricity consumption in the emirate, the equivalent of 44,386,471 MWh in 2014. The percentage allocation of this electrical usage by sector is shown in Figure 1.

Similarly, the Dubai Electricity and Water Authority (DEWA) in Dubai reports the same trend with an overall consumption of 33,659,150 MWh for 2015 is indicated in Figure 2.

Comparing the trend of building consumption to 2010, we observe an increase of 35% in consumption in 2014 compared to 2010 levels in Abu Dhabi alone, while the differences were less pronounced in Dubai, with only a 17% increase.

## POTENTIAL IN THE UAE

Considering the aforementioned electricity consumption analysis, energy efficiency experts believe that 1 billion AED in savings

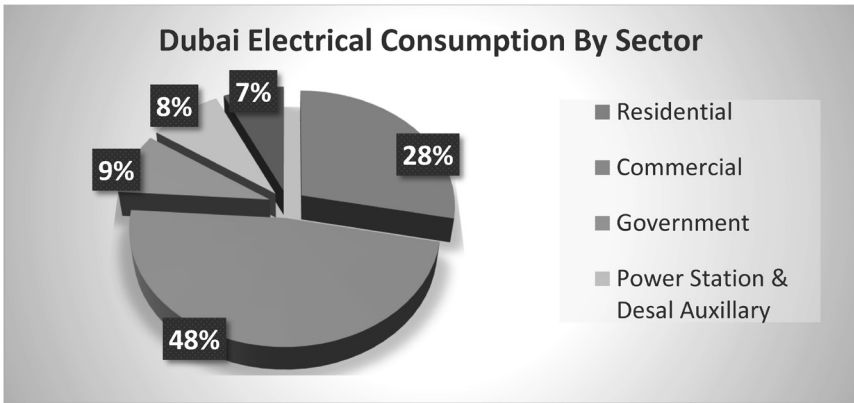


Figure 1. Electricity consumption per building category for the Emirate of Abu Dhabi.

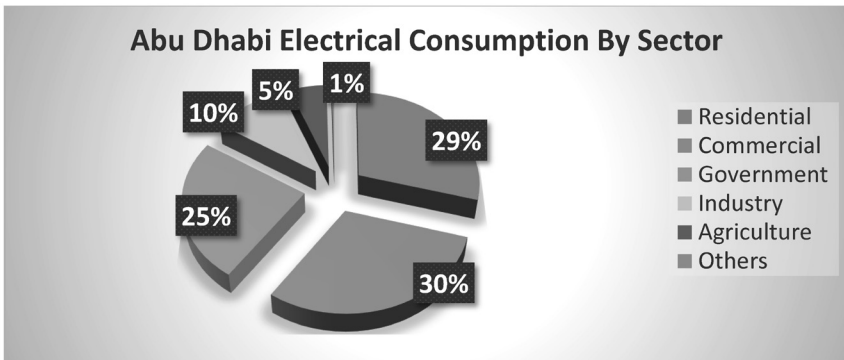


Figure 2. Electricity consumption per building category in the Emirate of Dubai.

could be achieved with a mere 10% energy consumption reduction in the buildings sector (residential, commercial, governmental and private buildings). This is based on the current average electricity tariff in Abu Dhabi and Dubai. If a 10% annual saving target is applied to 40% of the existing buildings in the two emirates with a 70% success rate for the retrofits and a simple payback period of 3 years, this will generate a market potential of over 2 billion AED for all stakeholders. Figures 3 and 4 represent the market potential analysis for both emirates.

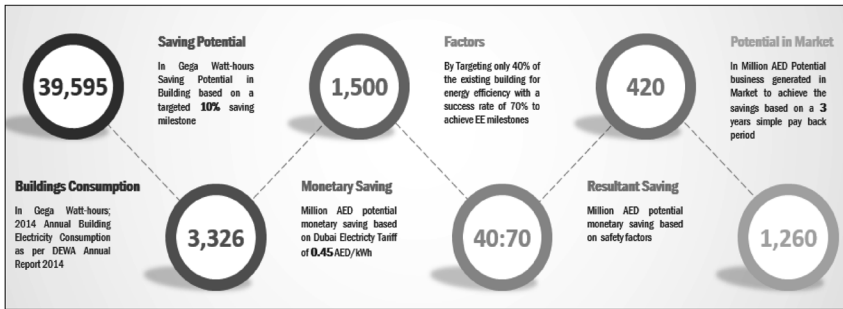


Figure 3. Potential in Dubai market.

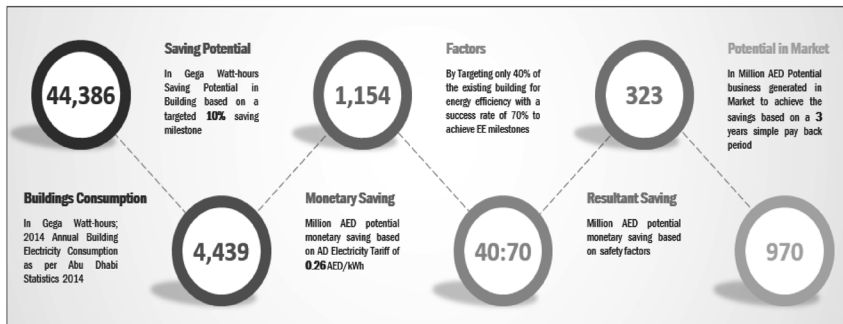


Figure 4. Potential in Abu Dhabi market.

THE WAY FORWARD

Energy efficiency is a strategy, and as with any strategy three essential elements need to be considered for it to succeed: focus, measurements and accountability.

Focus—by identifying how the building performs or where the facility lies in the scale of consumption. Priorities should be tied to specific, measurable, achievable, realistic and time (SMART) bounded goals. The priorities and goals could be represented in energy efficiency or energy management policies supported by management. They should be shared with the facility’s occupants, users and employees as part of the corporate policies to be implemented.

Accountability—by assigning a team that will take responsibility and ownership for executing the strategy. This team should have a di-

rect reporting channel to management.

Measurements—measuring progress and outcomes is challenging to assess. The ability to achieve the goals and to measure project outcomes represented in the savings is key to success. The unmeasurable is unmanageable.

Energy efficiency can be approached using different practices, schemes and nominations. These approaches differ in execution methods, contractual obligations, term and generated savings. A brief overview of some of these strategies is described below.

#### PLAN-DO-CHECK-ACT

The elements for an energy efficiency or energy management program can be described as the Plan-Do-Check-Act approach. This is a tiered process initiated by establishing the objectives and processes necessary to achieve the energy efficiency goals and milestones. This is documented in a published energy efficiency policy available to all building occupants.

Success depends on a well-defined energy consumption baseline with energy performance indicators which is supported by a feasibility study for the targeted measures along with a detailed action plan for implementation, measurement and verification. This “Plan” can be a detailed facility investment grade audit conducted by a dedicated energy manager or qualified project manager.

The “Do” phase includes the implementation of the planned energy conservation measures (ECMs). Implementation of these measures is supported by sufficient documentation, training and operational considerations.

A savings “Check” of the ECMs is performed when the implementation is completed. Detailed measurement and verification (M&V) of the energy savings is conducted with an analysis showing the savings based on the energy performance indicators. M&V along with energy monitoring and reporting helps identify deviations from the targeted performance indicators. It enables opportunities to further enhance the building operation and reduce energy consumption to be discovered. These activities are communicated to management enabling them to “Act” appropriately. It enables building occupants to highlight progress

toward energy goals, discuss achievements and implement preventive or corrective actions to further augment monetary savings. This ongoing process helps assure that the building is systematically operated in a manner aligned with the organizational polices.

### ISO 50001:2011

ISO 50001:2011—Energy Management System (EnMS) was officially launched in 2011. The standard states that the main objective of the standard is “to enable organizations to establish the systems and processes necessary to improve energy performance, including energy efficiency, use, consumption and intensity. Implementation of this standard should lead to reductions in energy cost, greenhouse gas emissions and other environmental impacts, through systematic management of energy.” This standard relies on the Plan-Do-Check-Act approach. It details the process to achieve energy efficiency and management goals within an organization.

Such an approach is applicable for organizations with corporate structures. It is suitable for industries in which processes need specific in-house expertise to assure all important energy uses are addressed. This requires in house engagement (top-down) along with a dedicated team led by an energy management champion or the energy manager. This approach needs an internal financing scheme which often initially focuses on no/low cost measures or medium cost measures with simple payback periods of 2 to 4 years.

### MONITORING BASED COMMISSIONING (MBCx)

Another proven approach toward energy efficiency for existing buildings focuses on systematically correcting system inadequacies. Monitoring based commissioning (MBCx) is a tiered process with of goal of providing sustained saving savings. MBCx involves three primary elements: retro/ongoing commissioning, measurement-based savings, and accounting using metered and monitored data. The process is similar to Plan-Do-Check-ACT with different implementation techniques and reporting structures. MBCx captures savings from three primary sources of costs:

- Savings from persistence and optimization of savings from ongoing commissioning based on early identification of deficiencies through metering and trending;
- Savings from measures identified through metering and trending; and
- Savings from newly identified measures using the energy monitoring and management systems.

MBCx further focuses on low cost measures that do not require substantial capital investment. The goal is to optimize the capabilities of the control and monitoring systems that control energy consuming electrical and mechanical systems such as lighting, heating, cooling and ventilating equipment. MBCx methodologies include:

- Repairing the basic functions using the existing monitoring and control systems;
- Enhancing the existing controls and operational systems; and
- Upgrading the existing equipment to improve operational efficiency (low hanging fruit).

MBCx has proven to be a viable model. A Lawrence Berkeley National Laboratory study [1] examined the findings for the commissioning of 643 existing and new construction buildings scattered in 26 U.S. states representing 37 different commissioning providers. The findings covered 99 million ft<sup>2</sup> (9.2 million m<sup>2</sup>) of building area and proved that a median energy saving of 16% is achievable in existing buildings with median benefit-cost ratios of 1.1 and 4.2 years.

This model is viable in the UAE due to the poor utilization of the potentials in the building energy management systems. Many are not well maintained, commissioned or are operated by non-skilled operators. The operation and maintenance practices in the region are not a priority for most building owners. Maintenance approaches tend to be reactive rather than preventive and predictive. Few facility management staff or companies incorporate energy management and efficiency services as key components of their contractual obligations and work procedures.

MBCx will be more important in the future. Previously subsidized energy tariffs remain low compared to the region's high per capita en-

ergy consumption. Enforcement of energy efficiency building codes and regulations has been lax. Utility tariffs have increased as governments have gradually released subsidies for energy and water bills. Such actions have increased utility tariffs in Dubai since 2009 and Abu Dhabi in 2015. Future actions are envisaged to support the movement towards greater efficiency and sustainability. These trends will increase the savings that will result from MBCx.

## ENERGY SAVING PERFORMANCE CONTRACTING

Energy savings performance contracting is available for organizations to implement energy efficiency projects. The responsibilities for planning, implementation, savings verification and other operational obligations are delegated to specialized services providers called energy services companies (ESCO). In the UAE, Etihad (Arabic for "Union") ESCO was formed as Dubai's official 'Super-ESCO' by DEWA and the Dubai Supreme Council of Energy in 2013. With a vision of making Dubai one of the world's most sustainable cities, one of their goals is to improve energy and water efficiency in existing buildings using energy savings performance contracting [2].

Performance contracting is a challenging business model with many associated risks including extended contract terms, variable project volumes and guaranteed returns on investment. It is initiated by a management commitment for energy efficiency. Detailed planning and a framework for periodic checks of milestones and key performance indicators are needed for existing buildings. Project implementation, execution and handling require specialized and high caliber expertise. A contractual framework is required for corrective action when deviations from projected savings occur. Periodic assessments are necessary for monitoring, verification and reporting to assure sustained long-term benefits.

Financing is a key driver toward ESCO business viability. In Dubai, project financing alternatives for ESPC projects are being tested. These take the forms of financing schemes, legal frameworks, and M&V approaches. Financing options are a bottleneck for the success of the ESCO business model due to high transaction costs, high interest rates, insurance, guarantees and performance bonds. These usually amount to 12% to 16% of an ESPC project's revenue. The associated financial risks



of this model could be mitigated through financing schemes based on successful business case studies such as those funded by the government. Without the mitigation of financial risks, the success of the ESCO industry will be limited and restrained. As ESCO contracts are linked with energy savings and CO<sub>2</sub> emission reductions. There will be considerably more challenges in the future.

### References

- [1] Lawrence Berkeley National Laboratory (2009, July 21). A golden opportunity for reducing energy costs and greenhouse gas emissions. Prepared for the California Energy Commission.
- [2] Etihad Energy Services (2017). About Etihad ESCO. <http://www.etihadesco.ae/about-etihad-esco>, accessed March 14, 2017.

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### ABOUT THE AUTHOR

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