Arab Future™ Energy Index

AFEX 2017

Energy Efficiency

RCREEE

Regional Center for Renewable Energy and Energy Efficiency

المركز الإقليمي للطاقة المتجددة وكفاءة الطاقة

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About AFEX

The Arab Future Energy Index (AFEX) is the first native Arab index dedicated to monitoring and analyzing sustainable energy competitiveness in the Arab region. AFEX offers both quantitative and qualitative analysis for key renewable energy and energy efficiency market drivers. Countries are ranked under 30 indicators that illustrate key energy market aspects, including policies, institutional and technical capacities, strategies, socioeconomic data and investments. AFEX data is collected through both international and local resources to guarantee accuracy and transparency. AFEX is published annually and consists of two components: AFEX Renewable Energy and AFEX Energy Efficiency. This year, AFEX Energy Efficiency ranks 20 Arab states and provides tailored recommendations for countries to help improve their transition towards sustainable energy pathways.

Countries of assessment include: Algeria, Bahrain, Djibouti, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, UAE, and Yemen.
AFEX is a product of the Regional Center for Renewable Energy and Energy Efficiency (RCREEE), an independent not-for profit regional organization, which aims to enable and increase the adoption of renewable energy and energy efficiency practices in the Arab region.
AFEX Energy Efficiency 2017 is produced with the support of United Nations Development Program (UNDP) and its Arab Climate Resilience Initiative (ACRI).

Authors

Rawad Rizk, Hussam Alherafi and Meredith Brand.

AFEX EE contributors

Abdullah Ajlan, Akram Al Mohamadi, Ali Khazma, Assem Korayem, Eman Adel, Hamza bouadane, Hiba Saadaoui, Karamy Saeed, Khalid Hashim, Khalid Salmi, Mazen Al Qadi, Mohamed Mahgoob, Sonia Al Zoghoul and Yasmeen Orabi.

Topical contributors

Special focus section on EE Job Creation in Tunisia by Steffen Erdle, Ulrike Lehr, Rafik Missaoui, a contribution from RE-ACTIVATE Project ("Promoting Employment through Renewable Energy and Energy Efficiency in the Middle East and North Africa") implemented by the German Society for International Cooperation (GIZ) for the German Ministry of Economic Cooperation and Development (BMZ).

Special focus section on EE Job Creation in Egypt by Steffen Erdle, Ulrike Lehr, Maximilian Banning, Anhar Hegazi, Ahmed Youssef and Rana El-Guindy, a contribution from RE-ACTIVATE Project ("Promoting Employment through Renewable Energy and Energy Efficiency in the Middle East and North Africa") implemented by the German Society for International Cooperation Cooperation and Development (BMZ)

Reviewers

Kishan Khoday, Team Leader in the Arab Region, Climate Change, DRR and Resilience, UNDP
Stephen Gitonga, Regional Sustainable Energy Specialist, UNDP
Walid Ali, Regional Climate Change Specialist, UNDP
Ahmed Badr Executive Director, RCREEE
Ammar Al-Taher, Key Expert "Technical Assistance to the Renewable Energy and Energy Efficiency Programme in Jordan
Ashraf Kraidy, Planning director, RCREEE
Maged Mahmoud, Technical Director, RCREEE

Design and layout

Mohamed Emad Eldin

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Arab Future Energy Index™(AFEX) Energy Efficiency 2017

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المركز الإقليمي للطاقة المتجددة وكفاءة الطاقة

Arab Future Energy Index 2017
UNDP Foreword

The entry into force of the Paris Agreement on Climate Change and the Sustainable Development Goals (SDGs) has helped raise issues of climate change and sustainable energy up the policy agenda. In the Arab region, a series of new sustainable energy strategies have arisen in recent times, meant to reduce the energy intensity of growth and enhance the resilience of development. In the Arab region, low-carbon, sustainable energy can play an important part of recovery from crisis, reducing poverty, expanding education and improving health outcomes.

Energy efficiency is the most cost effective means of reducing the energy intensity of the economy and promoting a low-carbon future. Efficiency improvements can save governments, companies, and citizens billions of dollars in the region from reduced energy bills, while at the same time quickly reducing carbon footprints – a win-win solution. Many countries in the region are now moving ahead with new laws, policies, and regulations to improve energy consumption but much more needs to be done to accelerate results and achieve SDG 7 on sustainable energy.

The United Nations Development Programme (UNDP) is pleased to partner with the Regional Centre for Renewable Energy and Energy Efficiency (RCREEE) in producing the 2017 edition of the Arab Future Energy Index which chronicles local progress made by our partners across the region. UNDP support is provided under UNDP's Arab Climate Resilience Initiative, which seeks to expand the knowledge base in the region on climate change and sustainable energy goals.

The 2017 AFEX report uses over 30 indicators to rank Arab countries on progress made to achieve energy efficiency targets based on regulatory and institutional structures, financial innovations, policy frameworks and public and private investments. AFEX rankings show important trends and emerging pathways to a low-carbon, sustainable energy future in the region. However, while showing progress, the report also notes many continued challenges, including inefficiency of energy use in building, transport, urban planning and infrastructure sectors, and continued challenges related to energy subsidies.

UNDP is proud to support the League of Arab States, RCREEE, and our national partners' transition to a sustainable energy future. UNDP has been a champion in advancing this agenda through public-private partnerships and energy market transformation. Through an ongoing portfolio of close to US$3 billion of grants for climate action in over 140 countries, our projects support new climate policies, technology, access to climate finance, including improvements in energy efficiency, expanded use of renewable energy and access to sustainable energy for the poor and most needy in society.

As seen in AFEX, important examples are arising across the region on how innovative partnerships can help 'de-risk' the policy environment for action, through a combination of new policies, capacities, and awareness that lead to scaled-up investments in sustainable energy. The Paris Agreement and SDGs provide a platform for new partnerships between the UN, regional bodies, governments, industry, and civil society. Seizing new levels of ambition in the region towards local climate action – and supporting this acceleration – not only protects the planet, it builds the social and economic resilience of countries, and empowers emerging leaders in the fight against climate change.

Khaled Abdelshafi, Director, UNDP
Regional Hub for Arab States

Arab Future Energy Index 2017
RCREEE Foreword

As part of a global effort to combat the impacts of climate change, around 195 countries adopted for the first time in over 20 years of negotiations during the 21st Conference of Parties (COP21) of the UNFCCC a unified legally binding climate deal to limit the global temperature rise well below 2^0C. As part of the Paris agreement almost 12 Arab states have submitted their first nationally determined contributions (NDCs) and action plans to both combat climate change and adapt to its impacts.

Although, working toward expanding the renewable energy market is highly essential for Arab countries to increase their energy supply, reduce their reliance on fossil fuels and achieve their respective NDCs according to the Paris Agreement, energy efficiency remains the region's cheapest, cleanest and most sustainable source of untapped energy. In an effort to reduce their energy demands and transition toward low carbon economies, around 15 Arab states have already implemented energy efficiency action plans while four others are under preparation. The Arab region also witnessed a historical progress toward the reform of its electricity and fuel subsidy systems and the liberalization of its fuel prices.

In its third edition, the Arab Future Energy Index provides a detailed overview on the progress of 20 Arab countries in their transition toward an efficient energy market post recent plunges in oil prices and economic turmoil in the region. The AFEX – Energy Efficiency focuses on the energy subsidy reforms undertaken by each country, their dependency on fossil fuels, efficiency of their utility sectors, and the implementation of energy efficiency action plans, targets, regulations and laws across the various sectors. The publication also provides a comprehensive insight into the presence and adequacy of implementing institutions and the degree of enforcement of energy efficiency laws. It identifies an analysis on current barriers for energy efficiency and offers recommendations to overcome them. The publication provides a great opportunity for Arab countries to learn from each other's achievements and success stories in energy efficiency measures, policies and technologies.

The Regional Center for Renewable Energy and Energy Efficiency (RCREEE) has been honored with the partnership and continuous support from the United Nation Development Program (UNDP) to the AFEX. The continuous support from UNDP has enabled us to expand our coverage to add three additional countries to this year's version of the AFEX-EE (Djibouti, Mauritania, and Oman). I would also like to thank everyone who was involved in developing this publication including RCREEE staff, our regional experts, our local focal points for each member state as well as our external reviewers and contributors.

The goal of the AFEX-EE and RCREEE has always been to provide the Arab region with the necessary knowledge and tools to integrate the various aspects of financial, social and environmental approaches in their transition toward an energy secure future and a better quality of life for the Arab world.

Dr. Ahmed Badr

Executive Director, RCREEE

About UNDP

The United Nations Development Programme (UNDP) is the United Nations' global development network, working in over 170 countries and territories to achieve the eradication of poverty, and the reduction of inequalities and exclusion. UNDP helps countries develop policies, leadership skills, partnering abilities, institutional capabilities, and build resilience in order to sustain development results. Through UNDP's extensive work at global, regional, and national levels, UNDP has learned that tackling climate change and expanding access to sustainable energy and water must be central to efforts to make results of development sustainable and resilient. UNDP is the UNs largest provider of assistance on climate change, with over $2.8 billion of grants to countries around the world. In support of the new Paris Climate Change Agreement and Sustainable Development Goals, UNDP helps countries transition to a low-carbon, climate-resilient development future. Support to countries is led by UNDPs extensive system of Country Offices and five UNDP Regional Hubs.

In the Arab region, UNDP has been present supporting development for over 50 years, including the past 25 years of experience supporting countries on climate change, energy, and environment agendas. UNDP support in the region has helped establish new policies and regulations to scale-up energy efficiency in key sectors like buildings and transport; new public-private partnerships for scaling up renewable energy technologies like solar and wind; new institutions and centers of excellence for low-carbon, sustainable energy solutions; and has helped expand access to solar energy for the poor, including those displaced by conflict. UNDPs Arab Climate Resilience Initiative has played an important role at the regional level, including strategic partnerships with the League of Arab States, the Regional Center for Renewable Energy and Energy Efficiency, the Arab Water Council, the OPEC Fund for International Development, and the Islamic Development Bank.

UNDP Regional Hub for Arab States

11 Abu Bakr Siraj Al-Din Street, Amman, Jordan

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About RCREEE

The Regional Center for Renewable Energy and Energy Efficiency (RCREEE) is an intergovernmental organization with diplomatic status that aims to enable and increase the adoption of renewable energy and energy efficiency practices in the Arab region. RCREEE teams with regional governments and global organizations to initiate and lead clean energy policy dialogues, strategies, technologies and capacity development in order to increase Arab states' share of tomorrow's energy.

Through its solid alliance with the League of Arab States, RCREEE is committed to tackle each country's specific needs and objectives through collaborating with Arab policy makers, businesses, international organizations and academic communities in key work areas: capacity development and learning, policies and regulations, research and statistics, and technical assistance. The center is also involved in various local and regional projects and initiatives that are tailored to specific objectives.

Having today 17 Arab countries among its members, RCREEE strives to lead renewable energy and energy efficiency initiatives and expertise in all Arab states based on five core strategic impact areas: facts and figures, policies, people, institutions, and finance.

RCREEE is financed through its member state contributions, government grants provided by Germany through the German Development Cooperation (GIZ) GmbH and Egypt through the New and Renewable Energy Authority (NREA). RCREEE is also financed through selected fee-for-service contracts.

Regional Center for Renewable Energy and Energy Efficiency (RCREEE)
Hydro Power Building (7th Floor)
Block 11 - Piece 15, Melsa District
Ard El Golf, Nasr City, Cairo, Egypt
Tel: +202 2415 4755
Fax: +202 2415 4661
ContactUs@rcreee.org
www.rcreee.org

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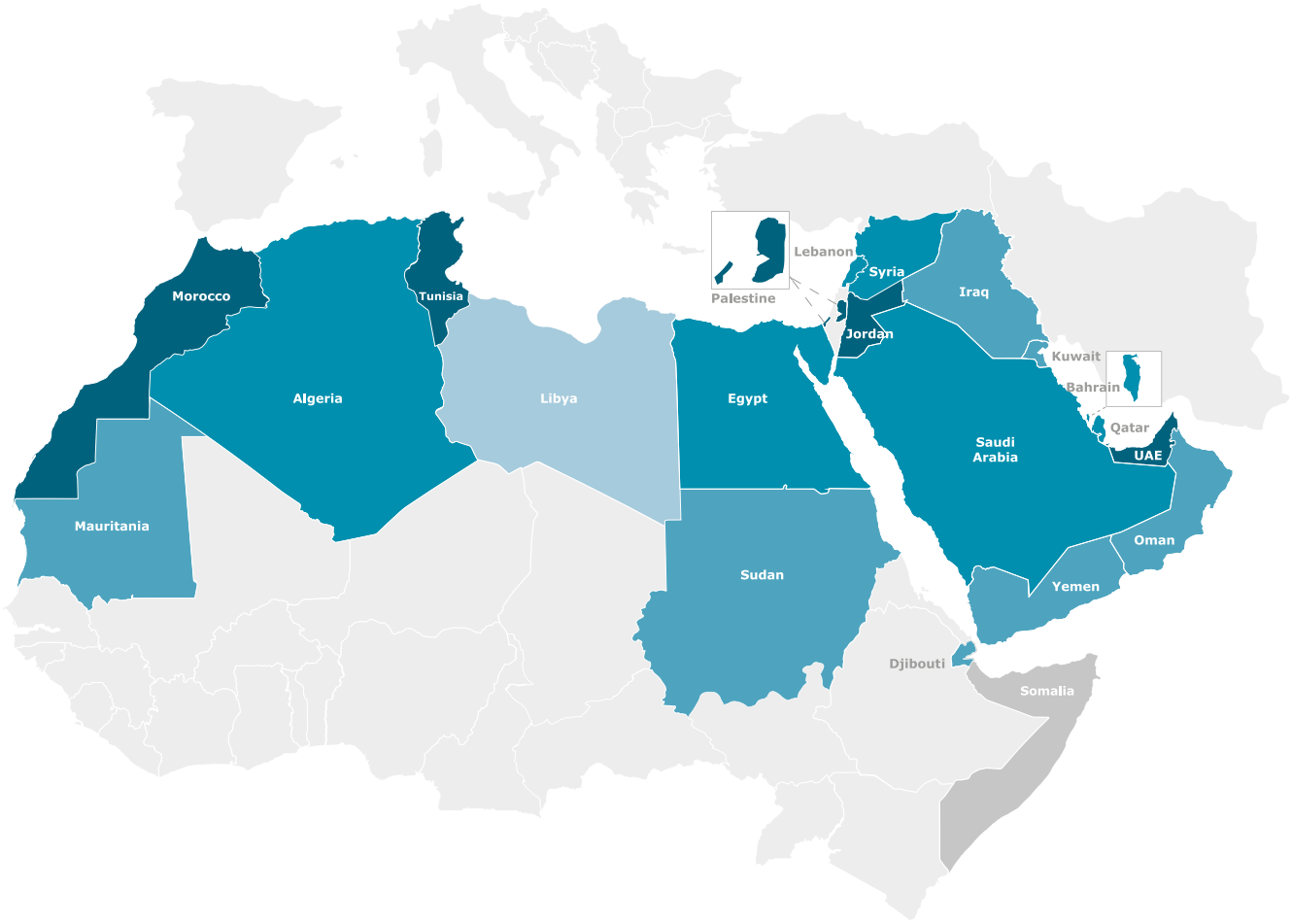
Energy Efficiency



Blue colors indicate overall ranks

- 80-100
- 60-80
- 40-60
- 20-40
- 0-20
- Other Arab states
- Rest of the world

Key Findings

The Regional Dimension

The AFEX Energy Efficiency 2017 details the efforts and progress achieved by Arab countries to develop their energy efficiency markets throughout the various sectors and put forth comprehensive roadmaps that effectively establish targeted EE programs and sources of finance. Energy intensity in the majority of Arab countries is still well above the European average energy intensity, indicating high energy requirements for economic development in the region. In general, energy intensity in the Arab region is driven by the region's economic growth (average 4.5% GDP growth/year based on 2010$), rapid industrialization, population growth (average growth 2.26%/year) and highly subsidized energy market. This high energy intensity has been translated into excessive CO_2 emissions, namely, in the GCC countries that record the highest CO_2 emissions/capita in the world. Managing and reducing energy consumption is both a vital cost saving initiative for Arab countries and significantly helps in scaling down the regional impact on climate change. continues progress to increase and promote energy efficiency is very important in helping Arab countries meet their nationally determined contributions (NDCs), in line with many countries' pledges following the Paris Conference of Parties (COP21) Agreement.

The UN adopted 17 Sustainable Development Goals (SDG) that address sustainable development in terms of social, economic, and environmental issues to be met by 2030. Arab countries' commitment to increase energy efficiency through their various adopted or planned energy efficiency strategies and National Energy Efficiency Action Plans (NEEAPs) demonstrate their commitment to the UN's SDG on energy (SDG7) that calls for global affordable, sustainable, and reliable access to clean and modern energy sources. Energy efficiency further helps Arab states meet their SDGs on combatting climate change and its impacts (SDG13), as it cuts down on GHG emissions resulting from excessive and inefficient consumption of energy. The 2017 AFEX monitors Arab countries' progress in fostering energy efficiency initiatives and strategies in line with established UN SDGs.

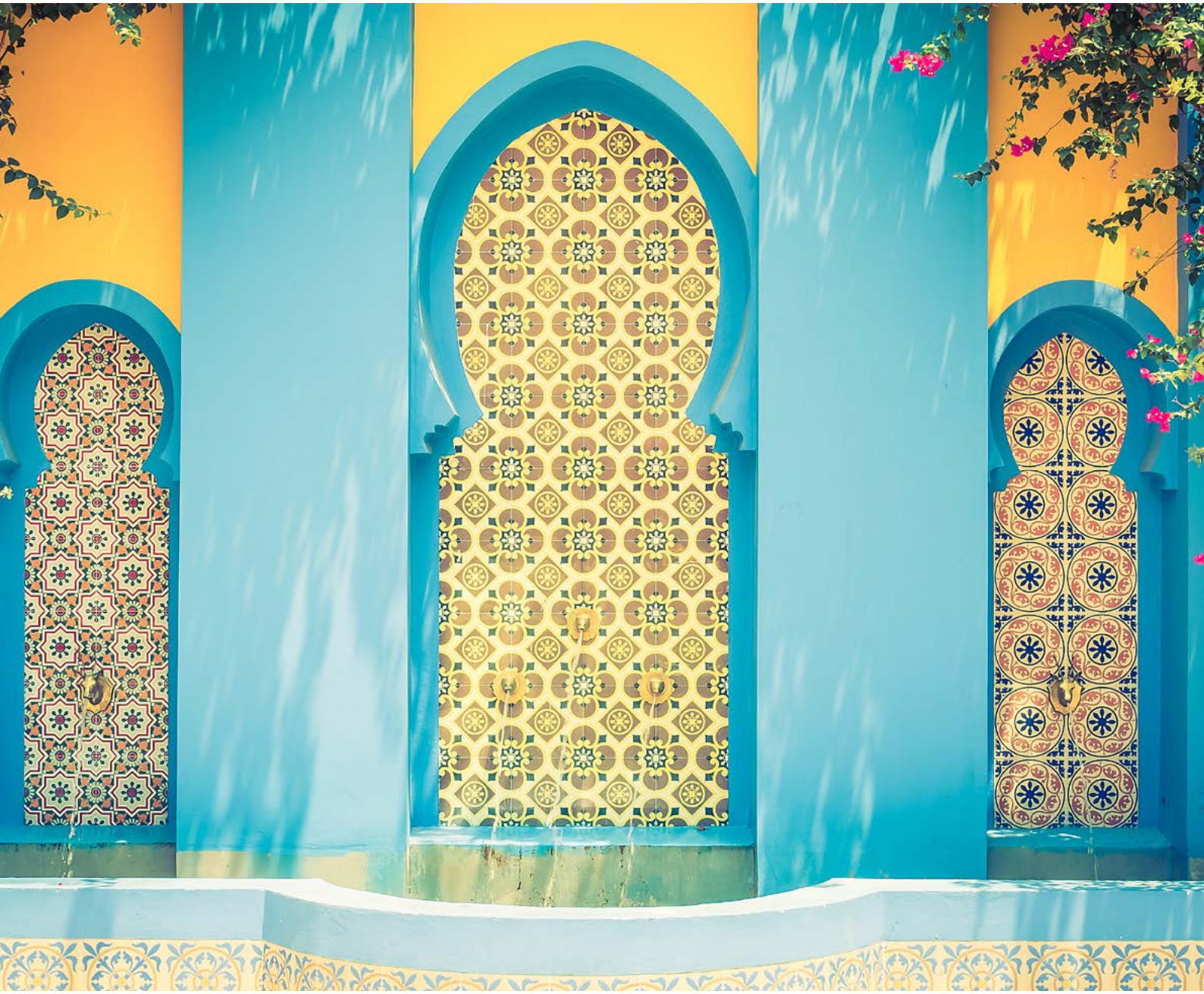
As of 2017, fifteen out of twenty Arab states studied in the AFEX have developed a national energy efficiency plan that articulates both short term and long term strategies to set state level policy goals for reducing energy consumption as well as to establish and implement effective EE initiatives and programs. Several Arab countries have spelled out their energy efficiency policies in national plans, such as Saudi Arabia, Morocco, Kuwait, and Tunisia. Many other Arab countries, however, have developed National Energy Efficiency Action Plans (NEEAPs), based on the Arab Energy Efficiency Guideline issued by the Arab Ministerial Council for Electricity (AMCE). RCREEE was mandated by the AMCE to monitor the qualitative progress and quantitative impact of NEEAPs and publish its findings in regular annual reports. Several Arab countries have evaluated their first NEEAP and are currently developing their second NEEAP, building on lessons learned from previous plans. Lebanon, taking a significant step forward, has evaluated its first NEEAP (2011–2015) and in 2016 adopted its second NEEAP (2016–2020). AFEX 2017 supports the implementation of this mandate by tracking the Arab countries' commitments to implement the Arab EE Guideline as well as their progress in improving energy efficiency across various sectors in line with the United Nations' Sustainable Development Goals 7 and 13.

In general, electricity and fuel prices in the Arab region remain well below the global average, as most Arab countries have spent significant portions of their GDPs on providing subsidies for electricity and fuel, resulting in a financial burden for these countries, namely after the 2014 drop in oil prices. These low prices of energy have greatly affected the level of energy consumption in the region leading to extremely high energy intensities and electricity consumptions per capita. Furthermore, the high level of energy subsidies implemented in the region, greatly hinders any incentive at the consumer side to reduce their energy consumption and invest in energy efficient technologies. Nonetheless, the recent drops in oil prices has, in part, encouraged Arab countries to undertake various reform actions and make progress in reducing their energy subsidies. The region witnessed an unprecedented wave of energy subsidy reforms as multiple Arab countries namely, Bahrain, Egypt, Jordan, Kuwait, Oman, Sudan, Syria, Tunisia, and the UAE have enacted policies to reduce electricity subsidies and increase fuel prices. Although these reforms were more significant in some countries than others, electricity and fuel prices remain well below the global average in most Arab countries.

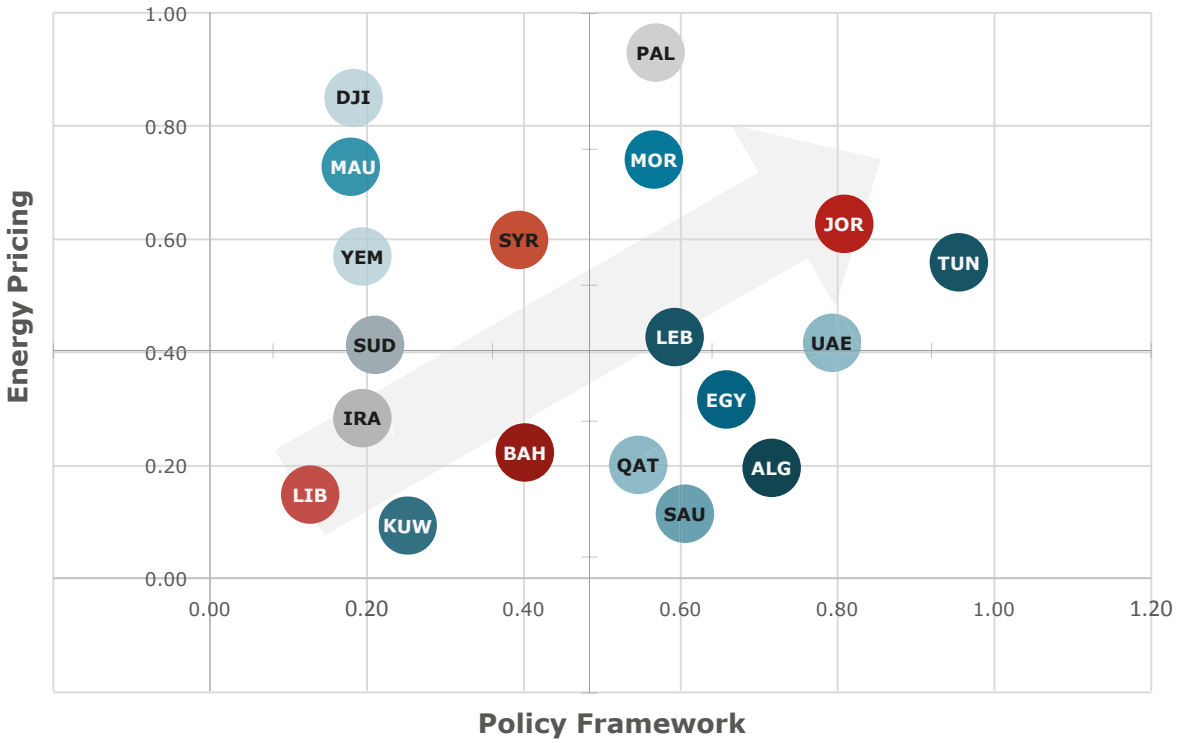
The region continues to witness progress in implementing policies to phase out inefficient lighting, which is exigent as lighting is responsible for nearly 34% of electricity consumption in the Arab region (Abdel Gelil, 2014). Many countries' energy efficiency plans have provided financial incentives for end users to switch to more efficient lighting, for example CFL or LED, or enacted bans on the sale of incandescent light bulbs. Although various Arab countries have adopted legislation and energy efficiency measures relating to appliances' energy standards and labeling namely for air conditioners and refrigerators, these standards and labels still lack adequate enforcement and diversification to include a wider range of appliances. Moreover, Arab country's still need to further develop and implement energy efficiency regulation, initiatives, and programs to reduce energy consumption in the transportation sector as it is responsible for around 30% of final energy consumption in the region (IEA, 2016). Although various countries such as Algeria, Egypt, Jordan, Qatar, Saudi Arabia, Tunisia and the UAE have ongoing or planned programs to improve public transportation, the national energy strategies of most Arab countries do not include energy reduction targets or reforms for the transportation sector. For example, tax reductions on hybrid cars, the enforcement of vehicle emissions regulations, and the promotion of public transport are notably absent.

Implementing national energy efficiency strategies hinges on stable sources of financing and legislation, and many Arab countries could improve on energy efficiency funding and legislation. Most Arab countries lack a dedicated energy efficiency agency within governmental bodies to regulate and set energy policy. In many Arab countries energy efficiency agencies are dispersed amongst different ministries and institutions, making it challenging to develop and enforce effective policies. Moreover, some Arab countries lack energy efficiency regulatory bodies all together. The increasing availability of funding for energy efficiency initiatives has seen a positive move in recent years to expand the EE market and develop EE projects in various sectors such as the Green Environment Financing Facility (GEFF) in Egypt, the Jordanian Renewable Energy and Energy Efficiency Fund (JREEEF), the Dubai Green Fund, and the National Energy Efficiency and Renewable Energy Action (NEEREA) in Lebanon.

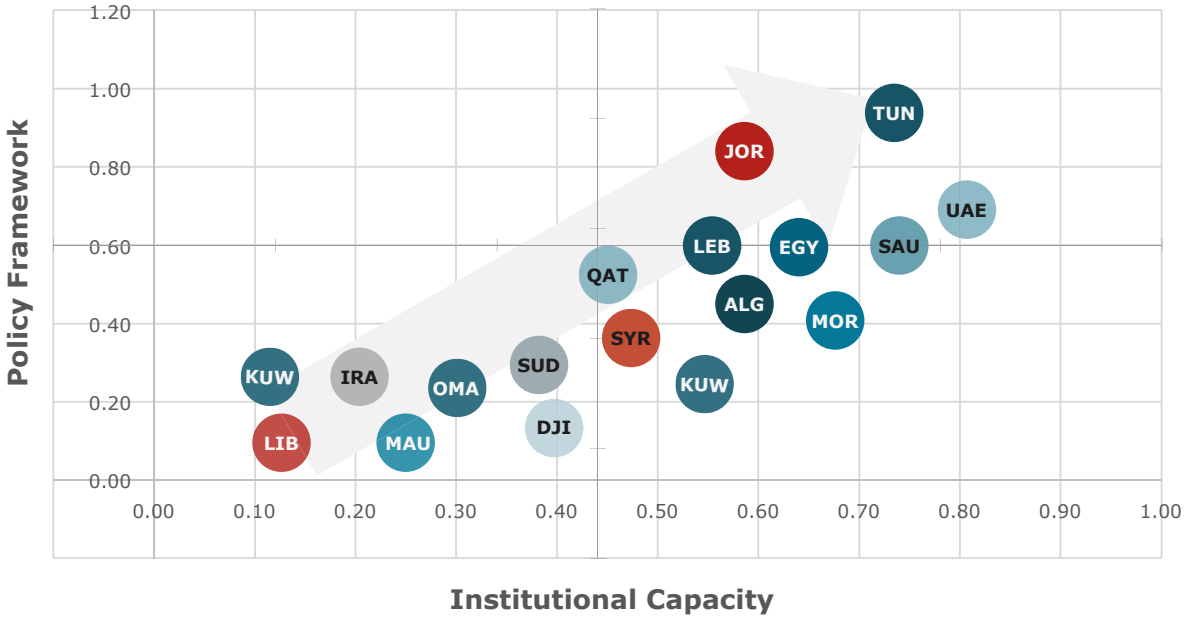
By developing and enforcing more effective energy efficiency policies, providing stable sources of finance for initiatives that improve energy efficiency, and taking decisive measures to remove energy subsidies, Arab countries can significantly improve their energy efficiency, and reduce their energy intensities. Such measures will save Arab countries large portions of their GDP and will cut down their energy bills, as well as help the region maintain its commitment to the UN's Sustainable Development Goals and their Nationally Determined Contributions.



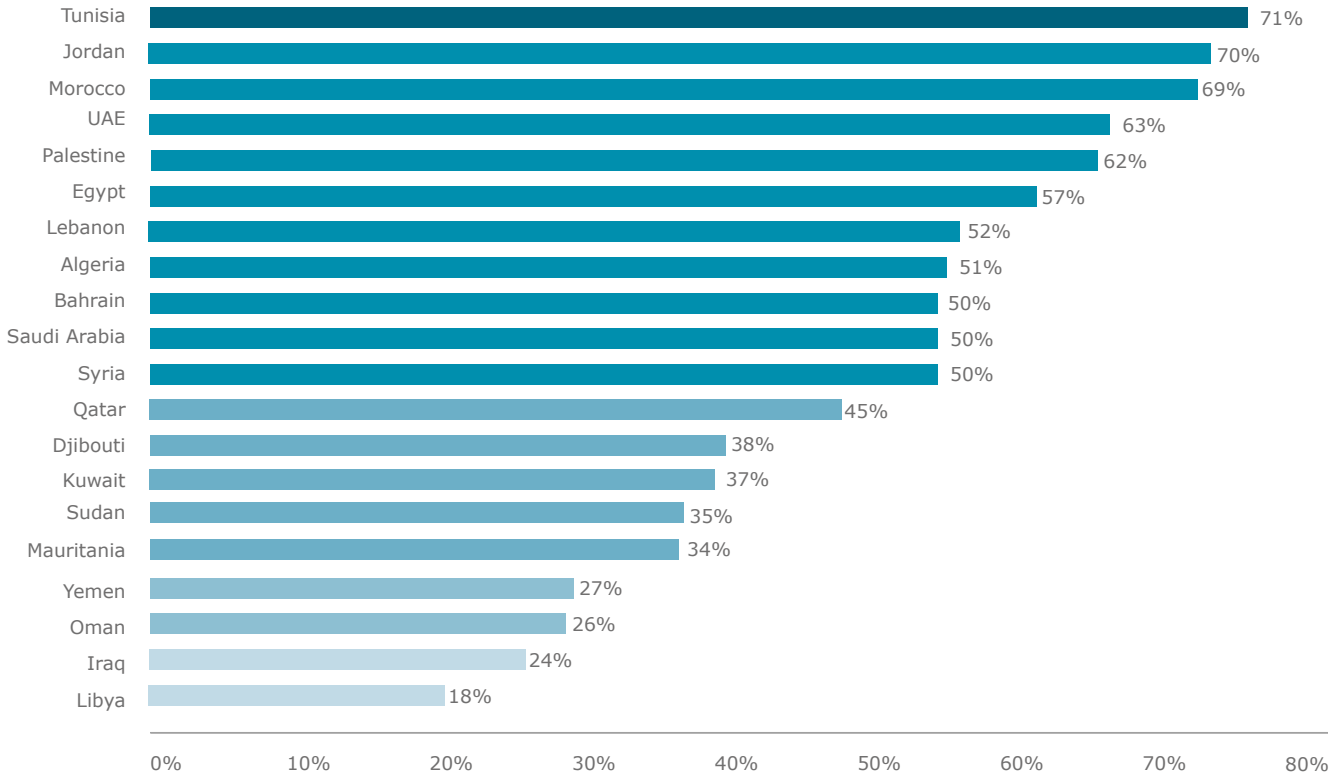
Countries' Two-Dimensional Performance



Countries' Two-Dimensional Performance



AFEX Energy Efficiency 2017 Results



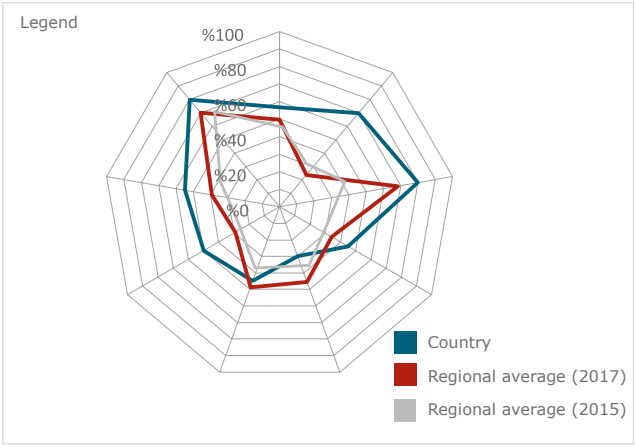
	Final Index	Energy Pricing	Policy Framework	Institutional Capacity	Utility
Tunisia	71%	53%	94%	73%	59%
Jordan	70%	65%	85%	58%	71%
Morocco	69%	85%	56%	67%	64%
UAE	63%	40%	72%	81%	54%
Palestine	62%	85%	59%	58%	35%
Egypt	57%	33%	64%	65%	78%
Lebanon	52%	39%	62%	55%	56%
Algeria	51%	19%	61%	64%	70%
Bahrain	50%	21%	47%	67%	79%
Saudi Arabia	50%	16%	60%	70%	58%
Syria	50%	62%	39%	47%	51%
Qatar	45%	19%	53%	45%	77%
Djibouti	38%	77%	16%	39%	-
Kuwait	37%	20%	26%	54%	59%
Sudan	35%	35%	22%	36%	58%
Mauritania	34%	76%	16%	24%	6%
Yemen	27%	57%	21%	10%	15%
Oman	26%	25%	20%	29%	36%
Iraq	24%	28%	20%	23%	21%
Libya	18%	15%	15%	12%	43%

By Country

AFEX Energy Efficiency 2017 assesses regional countries' progress in enacting energy efficiency measures based on four evaluation categories: Energy Pricing, Policy Framework, Institutional Capacity, and Utility. Within these four evaluation categories, each country's EE is further evaluated according to nine factors (Energy Subsidies, Electricity Price Structure, Energy Planning, Regulatory Framework, Financial Incentives, EE Intuitions, Implementation Capacity, Generation Efficiency, and Transmission and Distribution Losses) and 30 quantitative and qualitative indicators.

The diagrams presented below illustrate each regional country's scoring according to the nine factors listed above.

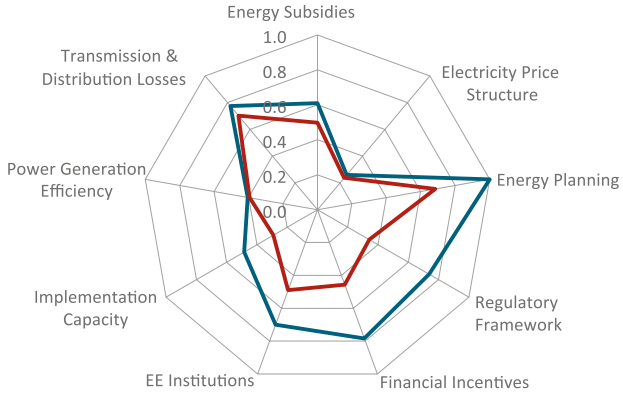
Overall, there is clear EE improvement in the region; almost every Arab state improved their efficient use of energy, compared to the rankings presented in the 2015 EE AFEX. In 2015, 6 out of 17 or 35% of the evaluated regional countries had EE scorings above 50%. Two years later, 11 out of 20 or 55% of the regional counties have EE scorings above 50%. Accordingly, the changes in the 2017 EE rankings do not show that a specific country did poorly; rather the rankings show that some countries made significant EE improvements, while other countries' performance remained the same. For example, Qatar fell in ranking from 4th in 2015 to 9th in 2017; however, their EE scoring went up by 4%.



Note: The figure above is for illustration purposes only and does not represent any specific country

TUNISIA

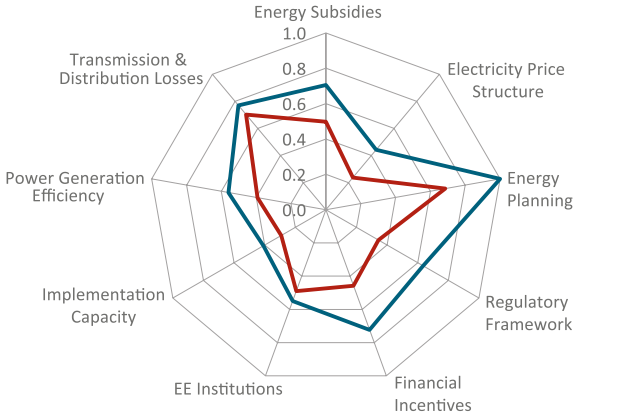
SCORE 71



Tunisia continues to lead the ranking in energy efficiency in the Arab region and continues to demonstrate commitment towards further improving the country's efficient use of energy. The country's overall EE score rose from 66% in 2015 to 71% in 2017. The country has seen continues success in EE planning, regulatory framework, financial incentives, and EE institutions, which all continue to remain well above the regional average. Although Tunisia's electricity prices in the residential sector are one of the highest between Arab countries, its electricity prices in the commercial and industrial sectors as well as its fuel prices remain significantly subsidized. Nonetheless, Tunisia's planned 2017 budget, plans to increase electricity and gas prices, and save up to 175 million Dinar. Tunisia's EE success hinges on effective EE planning and policy set forth in the country's long term national energy strategy "Energy 2030" and its current "New Program 2013 – 2020" that establishes regulatory framework, implementation strategies, and financial incentives to increase the deployment of EE measures and technologies.

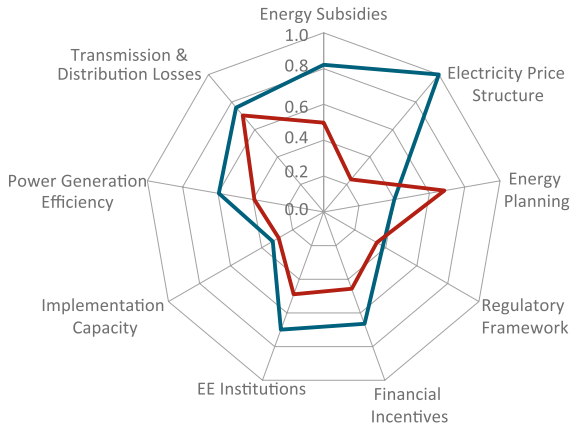
JORDAN

SCORE 70



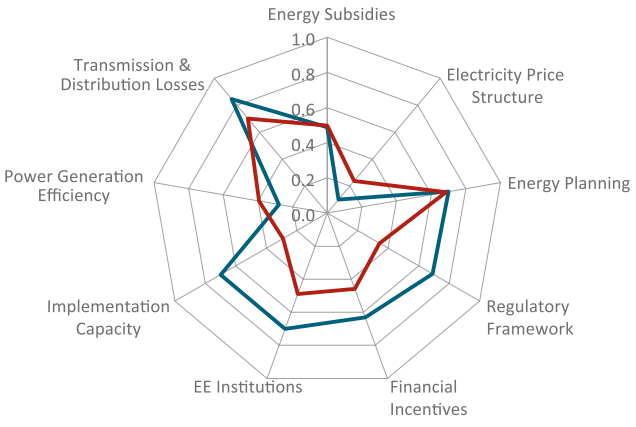
Jordan ranked second in the 2017 AFEX ranking with a total score of 70%. The country's institutional capacity increased by 20% from 2015, due to efforts to improve EE governing bodies and institutions, most notably with the newly founded Jordanian Renewable Energy and Energy Efficiency Fund (JREEEF). While Jordan is a leader in energy efficiency in the Arab region, there is still room for improvement in transmission and distribution losses, where the country is marginally above the regional average. Furthermore, in 2016 Jordan increased its gasoline, diesel and kerosene prices, which is a vital step in encouraging a more efficient use of fuel, especially for a net oil importing country. Energy planning notably improved from 2015, in part due to the evaluation of the country's first NEEAP and the preparations for the second NEEAP (2017 – 2020), which will provide a crucial roadmap to further improve energy efficiency in Jordan.

MOROCCO SCORE 69



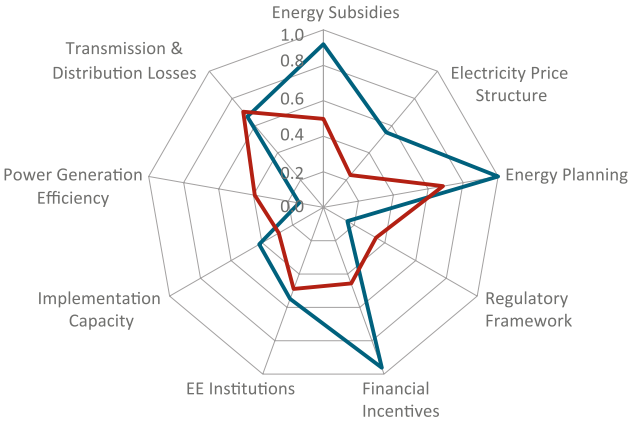
Morocco remains third in the region's EE scoring. One of the key strengths in Morocco's EE measures are the reduction in energy subsidies and the maintenance of its strong electricity price structure. By liberalizing fuel prices, the government was able to reduce spending on energy subsidies by an estimated about US$ 840 million in 2016. Morocco has maintained the highest fuel prices in the region with both gasoline and diesel prices above world average. Furthermore, as Morocco has the highest industrial electricity prices among Arab countries, those were used as the benchmark for calculating industrial electricity subsidies in the region. Morocco's long term energy strategy and energy efficiency goals (12% energy saving by 2020 and 15% saving by 2030) are supported by its US$ 1 billion Energy Development Fund (FDE). While Morocco's National Energy Strategy Horizon 2030 does set forth EE goals and establishes EE legislative framework, bylaws still need to be implemented for the success of planned EE initiatives.

UNITED ARAB EMIRATES SCORE 63



The UAE has made improvements in the Energy Efficiency field since 2015 in several sectors, particularly in implementation capacity and financial incentives. The inauguration of the Dubai Green Fund in 2017, an AED 100 billion credit line for EE and RE measures, provides vital funding for promoting and implementing EE projects. An increase in the regulation of energy consumption in the building sector and the provision of EE funding mechanisms has, in part, led to the UAE having the highest number of LEED certified buildings in the region and the 10th highest number in the world. The UAE's energy efficiency target is translated by both Abu Dhabi's Comprehensive Cooling Plan targeting a 15% energy demand reduction by 2020 from the base year of 2010, and Dubai's Integrated Energy Strategy targeting an energy demand reduction of 30% by 2030. One of the most prominent achievements in Dubai's energy efficiency market is the development of the Etihad Super ESCO. With a target of saving 1.7 TWh of electricity in more than 30,000 buildings by 2030, the super ESCO aims to create an effective market for ESCOs in Dubai using the Energy Performance Contracting (EPC) model. The UAE's electricity prices are considered above regional average in all three different sectors (residential, commercial and industrial) and increased by more than 30% for nationals at the beginning of 2017. Gasoline and diesel prices on the other hand remain relatively low in the UAE although prices increased by around 20% in November 2016 from their previous August 2015 values. Nonetheless, these recent significant reforms demonstrate a positive step forward in reforming the UAE's energy sector.

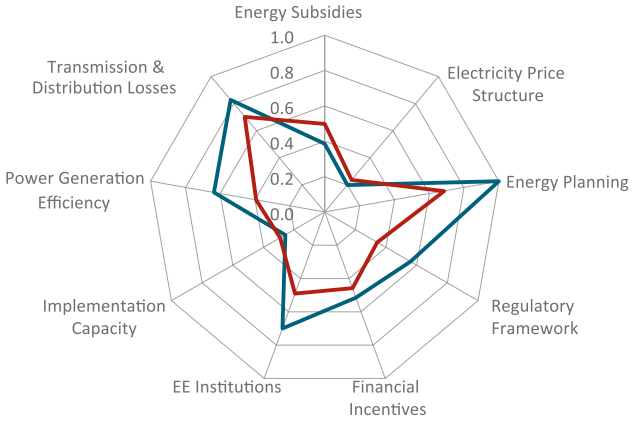
PALESTINE SCORE 62



While Palestine fell in regional rankings for EE index, it still increased its EE score from the 2015 rankings. Gasoline and diesel prices in Palestine remain the highest in the Arab region. Although electricity prices in Palestine were used as benchmark for electricity subsidy calculations for the residential, commercial and industrial sectors; recent changes in electricity subsidies have led to an increase in electricity prices in various Arab countries, so that Palestine is no longer the benchmark for regional electricity prices in the commercial and industrial sectors. Palestine still witness high electricity transmission and distribution losses. One significant area of improvement is Palestine's energy planning, is the evaluation of the country's first NEEAP (2012-2014) and the implementation of its second NEEAP (2015 – 2017) which provides a roadmap for EE development in Palestine.

EGYPT

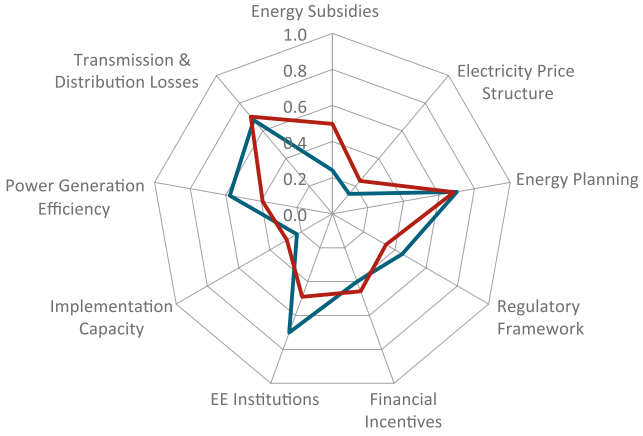
SCORE **57**



Egypt has made significant progress in the EE scoring since 2015 and has risen three places in the regional EE rankings. This progress is due to the implementation of several key EE policies. First, Egypt's EE planning has improved with the evaluation of its first NEEAP (2012-2015) and the preparation of its second national plan. Furthermore, the development of an EE unit within the Ministry of Electricity and Renewable Energy will help the government carry out the plans being drafted for Egypt's second NEEAP. Importantly, Egypt has also reduced subsidies for both electricity and fuel in recent years, as part of the government's 5 year plan to remove energy subsidies by 2020. Overall, these changes have helped Egypt increase its final EE score by 20% since 2015.

ALGERIA

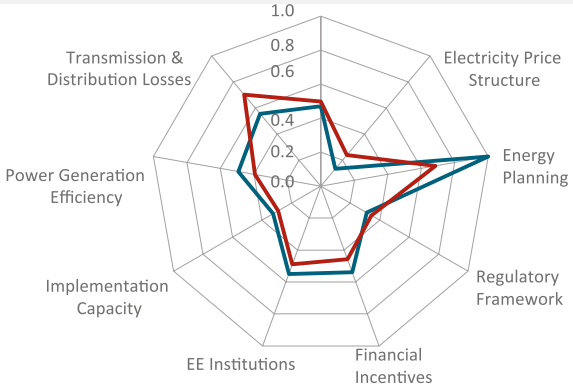
SCORE **51**



Algeria's EE policies and plans are mixed. On the one hand, Algeria has one of the region's most extensive set of laws and regulations for monitoring EE. Also, Algeria has an overall long-term EE plan in the form of the National Program for Renewable Energy and Energy Efficiency 2030. On the other hand, short term planning needs improvement as Algeria's last NEEAP ended in 2013 and another plan has not been prepared since. Energy prices in Algeria are heavily subsidized; yet a 2016 increase in gasoline and diesel prices by over 30% from the 2010 prices, points to positive changes in energy subsidy policies. A fund was established in 2017 with a portion of financing reserved for EE projects, this adds to the existing National Fund for Energy Conservation (FNME) and improves financial incentives for EE efforts.

LEBANON

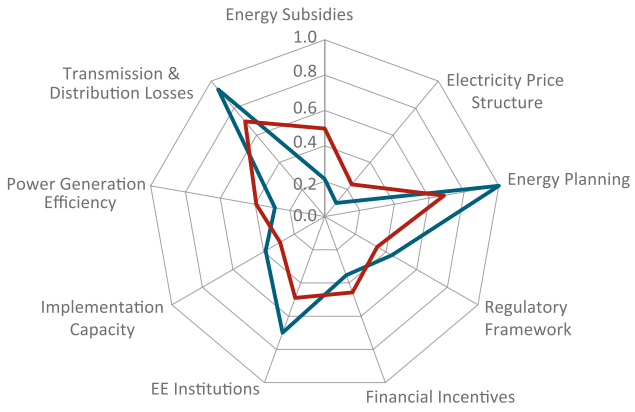
SCORE **52**



Lebanon evaluated its first NEEAP (2011 -2015) and adopted its second national energy efficiency action plan "NEEAP 2016 – 2020," which requires an estimated investment of 600 – 950 million US$ over the next five years to implement its measures. Lebanon's second NEEAP continues to build on the initiatives of its first NEEAP and further develop 26 energy efficiency measures that are expected to aid the country reduce its actual electric power growth rate from 7% to 5.8% by 2020. By refining its national energy policy based on lessons learned from its previous NEEAP, Lebanon is set to improve its EE policies and implementation of EE measures. Compared to its first NEEAP Lebanon's second NEEAP includes additional energy efficiency measures in the power sector, industrial, agricultural and transport sectors. Financial incentives for EE programs are a continued strength in developing Lebanon's energy efficiency market, with interest-free long term loans available for residential, commercial, non-profit and industrial customers seeking to invest in energy efficiency projects in new and existing facilities.

BAHRAIN

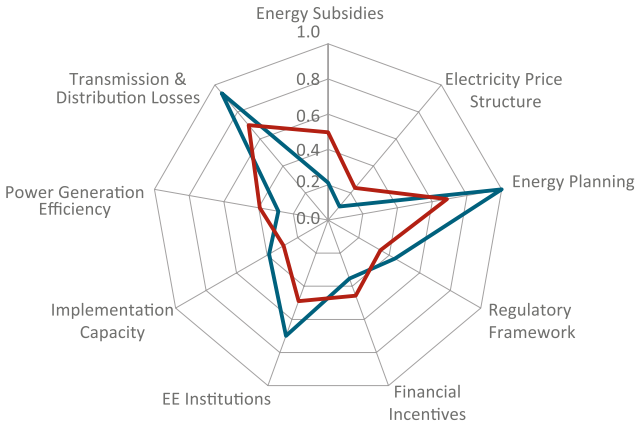
SCORE **50**



Bahrain has made a major step forward in EE by adopting the country's first NEEAP in 2017 that sets forth a road map for efficient use of energy. This marked improvement points to broader positive changes in energy policy in the country. However, Bahrain's energy prices are still heavily subsidized as the country's fuel and electricity prices are well below the region's average, which indicates the necessity for reform in the country's energy subsidy structure. Nonetheless, a step forward in reducing Bahrain's energy subsidies occurred in recent years as the country increased its electricity prices for residential expat consumers and such measures should be further expanded to nationals.

SAUDI ARABIA

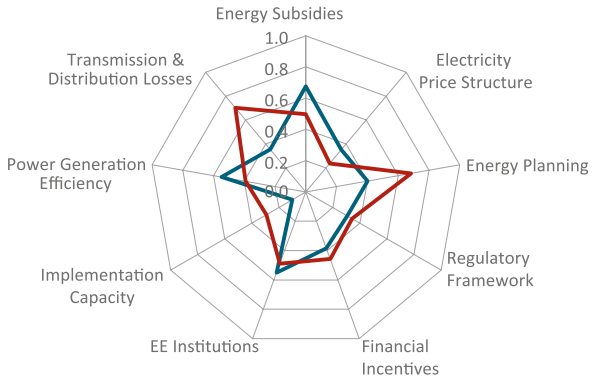
SCORE 50



As with several other Arab countries, Saudi Arabia's EE efforts indicate slow but positive signs of progress and improvement. Energy prices are heavily subsidized, with Saudi Arabia having some of the lowest gas and diesel prices in the Arab region. Thus, a reduction in energy subsidies is a vital area for improvement. There are two significant advancements in terms of EE scoring in Saudi Arabia. The first is the adoption of its national Energy Efficiency Program. The second is the implementation of Saudi Arabia's broad-sweeping plan Vision 2030 that has an integral component on energy sustainability. These two initiatives have greatly improved energy planning in Saudi Arabia, which previously scored well below the regional average in the 2015 AFEX.

SYRIA

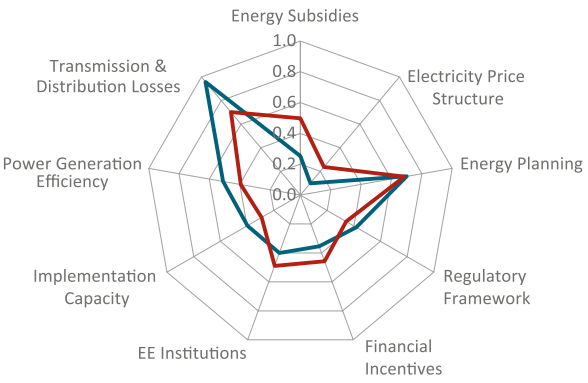
SCORE 50



Syria's difficult political situation has impacted the effective implementation of EE measures, however, several recent policies have been enacted to improve energy efficiency in the country. Currently, there is little in the way for energy planning measures, with the country's last draft for a NEEAP put forth in 2011 which was never officially approved. Syria, however, is reducing energy subsidies and increasing electricity and fuel prices for all types of consumers. As of January 2017, the domestic electricity prices in Syria more than doubled from their 2014 values, whereas the industrial and commercial tariffs increased more than 5 times compared to their 2014 values. However, due to the political turmoil in Syria, all initiatives and efforts to further develop the country's energy efficiency market and implement EE measures are currently halted.

QATAR

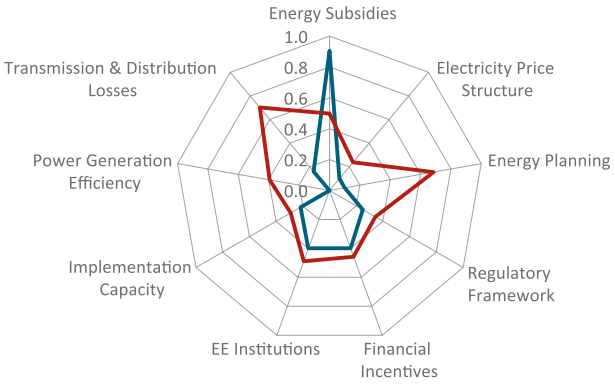
SCORE 45



Qatar's EE measures and policies have, for the most part, remained unchanged since 2015. Under the country's "Tarsheed" program (National Conservation and Energy Efficiency Program 2012-2017), Qatar has banned the import and sale of incandescent lights, promoting the use of EE lighting. Qatar has strong mandatory EE regulations in the building sector and has witnessed an increase in the number of LEED certified buildings, having the third largest number of LEED certified buildings in the Arab region after Saudi Arabia and the UAE. Like most GCC countries, Qatar has high energy subsidies that drive down the prices of electricity and fuel and weaken any incentive at the end user side to reduce energy consumption. This is reflected by the country having the highest electricity and energy consumptions per capita in the Arab region. Reducing these energy subsidies is an essential area for future development of the energy efficiency market in Qatar as well as to promote energy efficiency measures and technologies at the end user side. Finally, Qatar has various on-going or planned public transport projects across the country as well a railway project connecting the country with its GCC neighbors which are set to reduce the country's carbon footprint and energy consumption across its transport sector.

DJIBOUTI

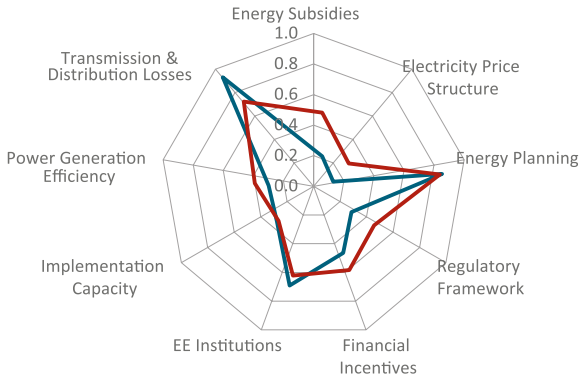
SCORE 38



Compared to other regional countries, there is less data on Djibouti's EE policies and programs. Better data collection and dissemination would help the country understand its energy usage patterns and formulate more effective EE policies. This was particularly problematic in the utility sector, where a lack of information hindered the analysis of this sector. From the available data, Djibouti has one of the lowest energy subsidies in the region, which is reflected in its high electricity and fuel prices. Currently, Djibouti does not have a comprehensive national plan for energy efficiency nor energy efficiency laws and as such the creation and implementation of such a plan and laws would be a major improvement in the country's EE strategy. The Ministry of Energy and Natural Resources does have a regulatory body for EE policy, ADME (Agency for the Control of Energy and Energy Efficiency Agency) that carries out limited EE audits and promotes EE for industrial equipment. Furthermore, small scale initiatives, such as awareness programs to promote the use of EE lighting are in place. Finally, there is limited funding from foreign governments and international bodies to develop EE initiatives in Djibouti.

KUWAIT

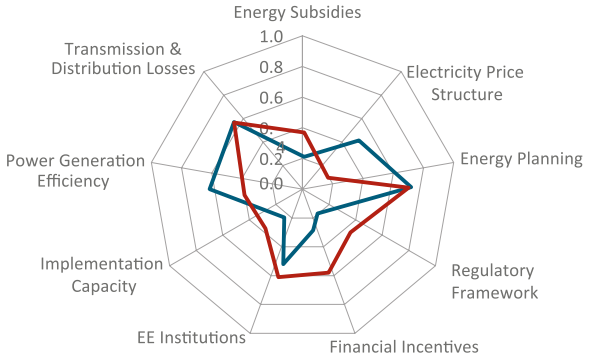
SCORE 37



Overall, Kuwait has made some tentative first steps in reforming energy subsidies, which is badly needed as the country has some of the lowest energy prices and one of the highest electricity and energy consumptions per capita in the region. Specifically, the government passed laws that will increase electricity prices for expat residential consumers and new tariff policies are set to raise commercial and residential electricity prices. While these positive policy shifts are important, more tariffs and subsidy reductions are needed to raise pricing to better reflect market value. Kuwait continues to focus on programs to reduce energy consumption in buildings through its Energy Efficiency Technologies (EET) program as buildings are the major consumers of electricity in the country due to the high air conditioning demand. Through various programs such as the amendment of the energy conservation code of practice which specifies minimum energy requirements for building lighting and air conditioning systems, as well as multiple energy audits in public and commercial buildings; Kuwait is implementing one of the most successful buildings EE initiatives in the region.

SUDAN

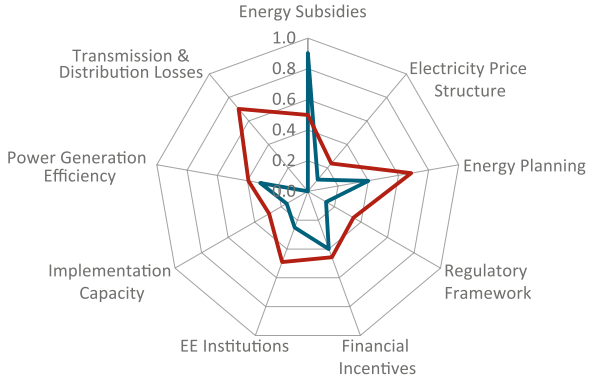
SCORE 35



There have been some improvements in Sudan's EE policies since 2015. Sudan is continuing its prepaid meters which also promote energy conservation, reduce non-technical losses in distribution networks, and improve payment rates with energy bill collection. In 2016, the government raised the price of gasoline and diesel, which is a positive measure; however, more reform is still needed to reduce energy subsidies. Sudan is an early adopter of the National Energy Efficiency Action Plan (NEEAP) process with its first NEEAP ending in 2016. Under this NEEAP (2013 – 2016) Sudan plans total energy savings of 4.5% by 2016 and 24.6% by 2020 from the base year of 2013. Sudan also joined the UN's en.lighten Global Efficient Lighting Partnership Program and has instituted measures to distribute around one million CFLs. Sudan's EE policy still needs improvement, particularly in the industrial sector and the establishment of EE laws and regulations is essential to improve the country's implementation and enforcement of EE measures.

MAURITANIA

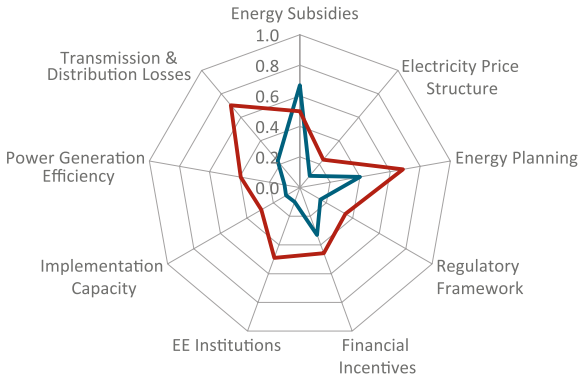
SCORE 34



Gaining a clear picture of Mauritania's EE policies and programs is hindered by lack of data. Better data collection and dissemination would help the country gauge it's energy usage patterns and better formulate policies to implement effective energy efficiency measures and strategies. Energy pricing in Mauritania is well above the regional average energy prices, which is a good incentive for end user energy conservation. Mauritania's commercial electricity prices, for example, were used as the benchmark in this year's AFEX electricity subsidy calculation for the commercial sector. Nonetheless a coherent and effective EE policies and laws are still lacking in the country. Mauritania is currently developing its first NEEAP, which should provide a clear guidance for the country's EE goals and is a crucial step in reducing the country's energy consumption and dependence on fossil fuels.

YEMEN

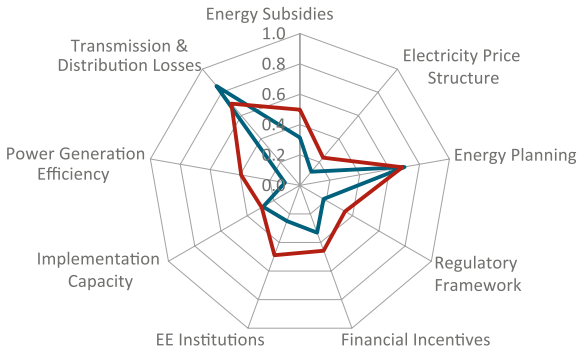
SCORE 27



Yemen's energy prices are currently above the regional average due to decreased fuel and electricity subsides in 2014. While Yemen has a long term RE and EE strategy with clear EE policy goals articulated, little progress has been made in enforcing this vision. Currently, Yemen is preparing its first NEEAP, which will help set short-term EE goals as well as establish and implement a set of effective EE programs and activities to achieve such goals. There are no EE laws or bylaws in the government; yet the Cabinet Decision No 302/2010 on governmental actions required for energy efficiency and rationalization of consumption is a move in the right direction.

OMAN

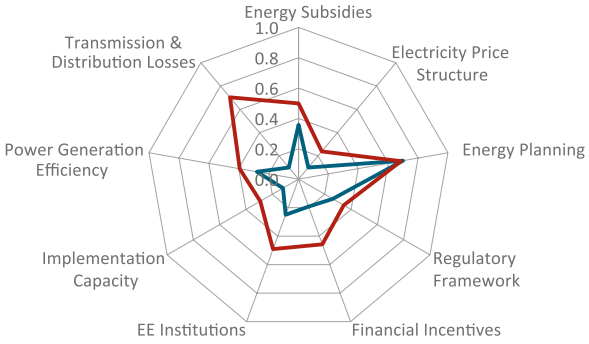
SCORE 26



Oman's most significant EE improvement is the increase in electricity tariffs for large industrial, commercial and governmental consumers. Gasoline prices also rose in 2016 by around 8% and diesel prices by 4%. Oman has a long term EE strategy and a national energy action plan with specific EE measures; however, the country still lacks EE laws and bylaws to help facilitate such plans. Oman is currently developing an EE agency in its governmental electricity regulatory authority, which will also help implement effective EE policies and measures. While Oman has a significant amount of work to do to improve the efficient use of energy, these upcoming changes point to an improvement in the country's EE planning.

IRAQ

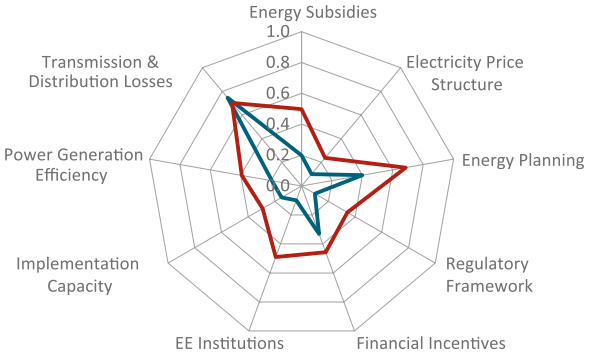
SCORE 24



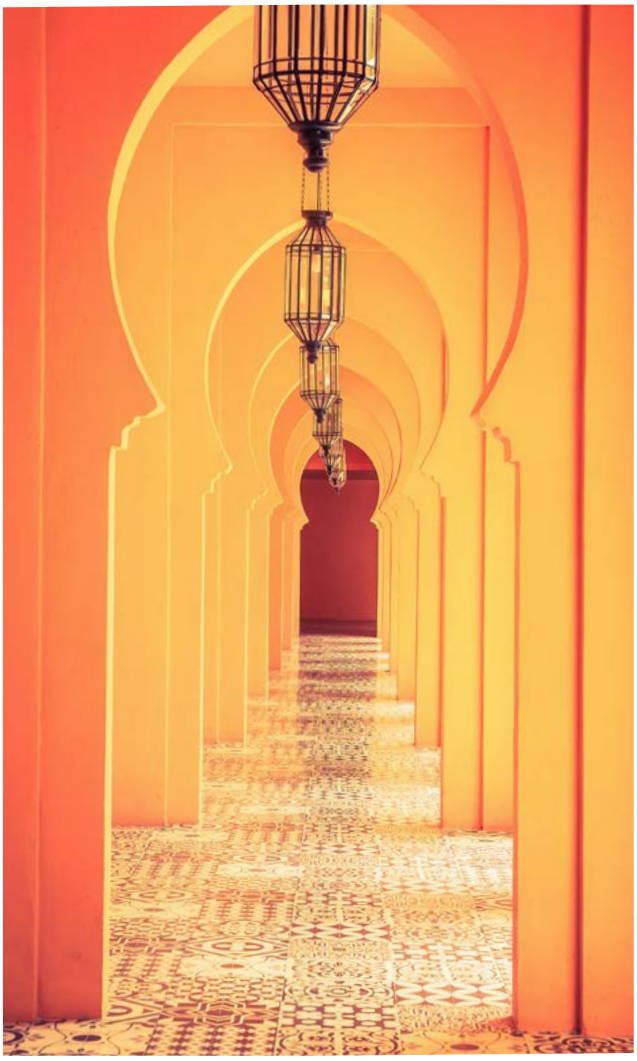
Iraq made significant progress in 2014, where the country adopted its first long term energy strategy "Electricity Master Plan 2030" with plans to improve efficiency in its refineries and utility sectors and its first national energy efficiency action plan (NEEAP). To date, however, there are no EE laws or bylaws to help enforce the various measures of its EE action plan. Many of the country's EE policies, such as EE building guidelines, are not mandatory. This lack of regulation makes enforcing EE strategies challenging. One positive measure is the ongoing development of an EE body within the country's Ministry of Electricity.

LIBYA

SCORE 18



Libya has made little substantive progress since 2015 in energy efficiency. With the lowest diesel and gasoline prices in the region and one of the lowest electricity prices, Libya needs to implement significant subsidy reform in its energy sector. Furthermore, Libya does not have a long term EE strategy and its' NEEAP (2014-2016) is still under final stages of approval. Developing and implementing and effective NEEAP would be a vital move to create a sound and comprehensive EE policy and program framework to achieve said goals.



Arab Future™ Energy Index

AFEX 2017

Energy Efficiency

1 Introduction

1. Introduction

The Arab Future Energy Index – Energy Efficiency (AFEX-EE) is the first Arab index dedicated to monitoring and analyzing the energy efficiency competitiveness in the Arab region and offers both quantitative and qualitative analysis of the energy efficiency markets in 20 Arab countries. AFEX Energy Efficiency 2017 marks the third edition of the publication. The various energy efficiency indicators utilized in the AFEX aim to support Arab countries in developing and implementing more effective energy efficiency policies and strategies as well as to evaluate existing energy efficiency institutions, policies, trends and infrastructure in the Arab region in order to encourage continuous improvement in the energy efficiency markets. Furthermore, the AFEX monitors the progress of Arab countries toward meeting both their short-term and long-term EE objectives and targets.

The Arab Ministerial Council of Electricity of the League of Arab States adopted the Arab EE Guidelines during their 26th Executive Office meeting that took place in Cairo on 23 November 2010. This Guideline is based on the EU directive 2006/32/EC on energy end-use efficiency and energy service known as "Service Directive". It is a 10-year framework program that requires a string of long term/short term indicative energy efficiency targets, and the preparation and implementation of three 3-year National Energy Efficiency Action Plans (NEEAPs). The process of translation, adaptation, and adoption of the EU directive into the Arab EE Guidelines took two years. This Guideline was circulated to the Ministers for national adoption according to Article 13 of the Guideline. Article XII of the guideline states that the RE/EE Expert committee, set up in accordance with the decision of the Arab Ministerial Council for Electricity No. 127, and the committee's work groups shall be responsible for monitoring the implementation of this guideline in coordination with regional and international institutions and specialized research centers. RCREEE was asked to monitor the qualitative progress and quantitative impact of National Energy Efficiency Action Plans (NEEAP) and to publish regularly an annual report about its findings. AFEX 2017 supports the implementation of this mandate that contributes in tracking regional implementation of Sustainable Development Goal 7 target on energy efficiency.

1.1. Objectives

AFEX Energy Efficiency is a policy assessment and benchmarking tool that aims to provide a comprehensive assessment of the current state of energy efficiency (EE) markets and quality of EE governance in the Arab region. The assessment is based on compilation and analysis of detailed country-specific data, according to the set of predefined indicators listed in Table 1. AFEX Energy Efficiency covers major sectors of the economy: residential, industrial, tertiary, transport, and utility.

AFEX Energy Efficiency aims to:

- Provide a comparative overview and comprehensive assessment of the current state of EE markets in the Arab region
- Benchmark each country's performance in EE
- Provide in-depth analysis of the quality of EE governance in the region
- Highlight developments and progress made by each country towards EE in 2014
- Effectively communicate EE success stories and areas for improvement
- Identify areas for possible intervention at the regional level to support EE efforts

1.2. Scope of Assessment

The conceptual framework of AFEX Energy Efficiency is presented in Table 1. It consists of four evaluation categories relating to the index's objectives and scope of assessment:

1. Energy Pricing: assesses the current structure of energy pricing, including prices of electricity, gasoline, and diesel

2. Policy Framework: assesses states' use of policy frameworks and level of commitment to overcome market, social, and political barriers to EE by formulating and adopting strategies, policies, and target-based action plans

3. Institutional Capacity: assesses the institutional capacity to design, implement, and evaluate EE policies

4. Utility: assesses the efficiency of the utility sector, including power generation efficiency and efficiency in power transmission and distribution networks

The four evaluation categories are broken into ten factors, which are further divided into sets of quantitative and qualitative indicators.

1.3. What is New in AFEX EE 2017

Scope of assessment: In the AFEX EE 2017 edition, the focus is on regional efforts in the field of electricity and fuel subsidy reforms, the development of National Energy Efficiency Action Plans, energy efficiency labeling for equipment, as well energy efficiency in the transportation sector. The scope of the report has further been broadened to include a review of socio-economic aspects related to sustainable energy, demonstrated by lessons learnt from the Tunisian and Egyptian experience.

Geographical scope: AFEX Energy Efficiency 2015 provided assessment of the EE situation in 17 Arab countries. The 2017 edition has expanded its geographical scope by adding three more countries to the assessment: Djibouti, Mauritania, and Oman.

1.4. How to Read the Report?

The report is structured according to the conceptual framework of the AFEX: (1) Energy Pricing, (2) Policy Framework, (3) Institutional Capacity, and (4) Utility. Analysis of the EE situation by sector is embedded throughout the report. For example, residential energy prices are provided in the Energy Pricing chapter, policies related to residential EE are provided in the Policy Framework chapter, and the assessment of implementation capacity of EE initiatives in the residential sector is provided in the chapter related to Institutional Capacity. Likewise, the EE analysis for commercial, industrial, and transport sectors can be found throughout the report.

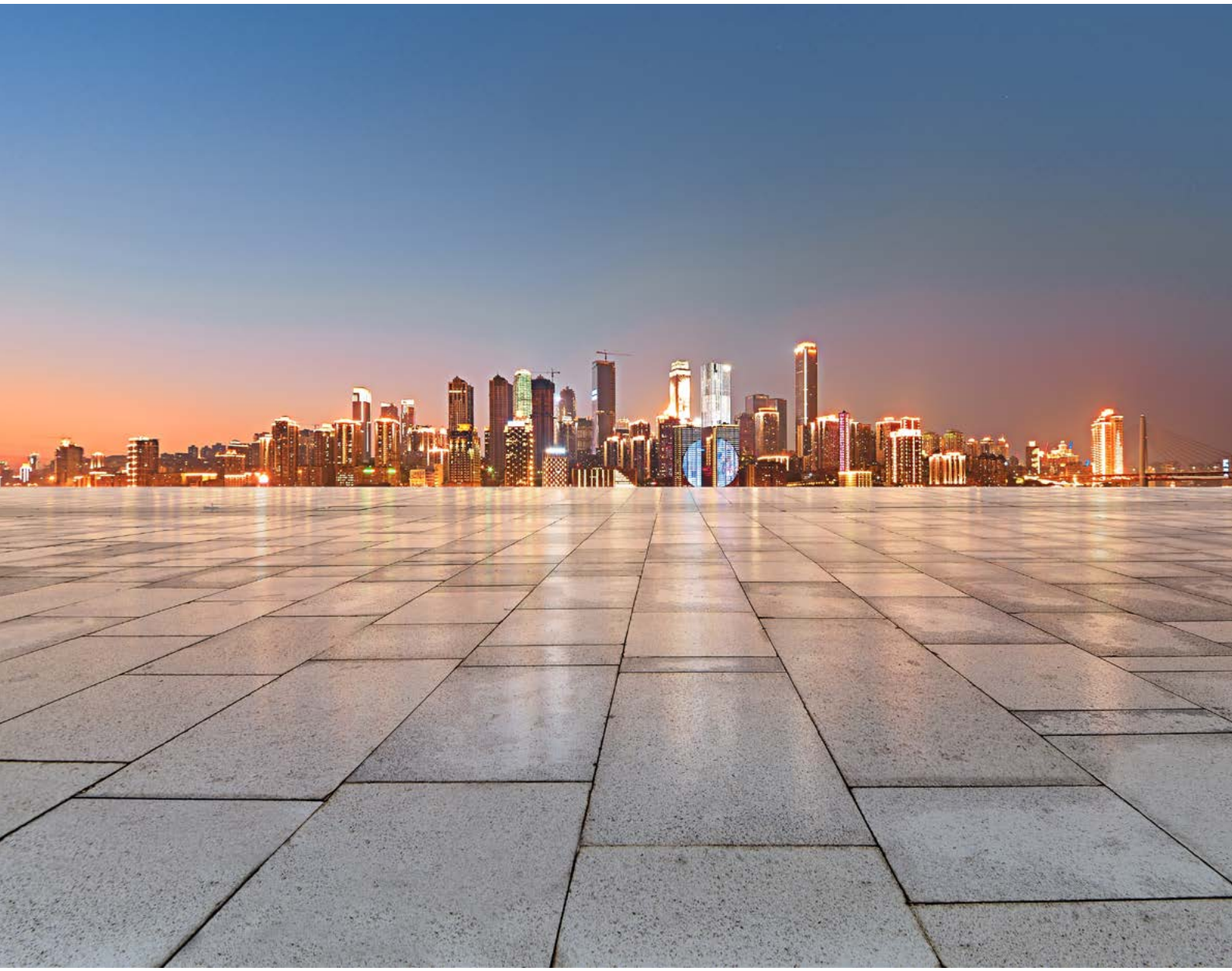
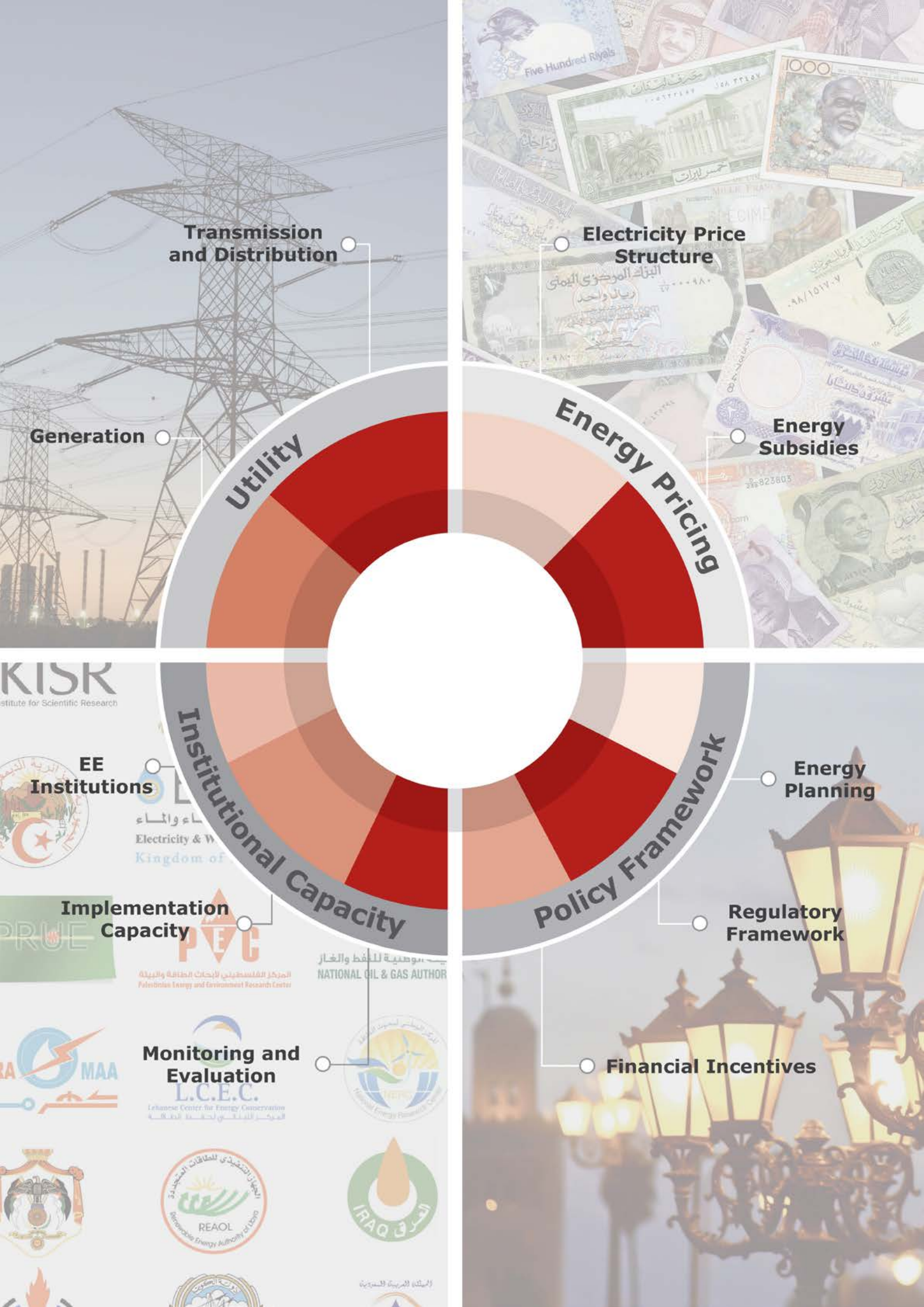


Table 1: AFEX Energy Efficiency Conceptual Framework

Category	Factors	Indicator	Score/Measuring Unit
Energy Pricing	Electricity Price Structure	Time of use price structure	Number of segments
		Other price-based incentives	Number of incentives
	Energy Subsidies	Electricity subsidies in residential sector	Subsidy percentage (benchmarked to Palestinian retail prices for electricity)
		Electricity subsidies in commercial sector	Subsidy percentage (benchmarked to Palestinian retail prices for electricity)
		Electricity subsidies in industrial sector	Subsidy percentage (benchmarked to Palestinian retail prices for electricity)
		Subsidies for gasoline	Retail price per liter
		Subsidies for diesel	Retail price per liter
Policy Framework	Energy Planning	Energy strategy with long term EE objectives	Officially adopted; non existent
		National Energy Efficiency Action Plan	Adopted; not adopted; under development
		Quantitative, time bound EE targets for residential, tertiary, industrial, transport and utility sectors	Adopted; not adopted; under development
	Regulatory Framework	Framework legislation for EE measures	Adopted; draft prepared; non-existent
		EE regulations for buildings	Mandatory; voluntary or under preparation; non-existent
		Statutory obligation to install solar water heaters in new buildings	Adopted; under preparation; non-existent
		Mandatory minimum energy performance standards with labeling schemes for household appliances	Number of appliances
		Regulatory phase-out of inefficient lighting technology	Policy adopted; under preparation; non-existent
		EE regulations for industries	Number of regulatory policies
		Regulatory phase-out of old or inefficient vehicles	Adopted; under development; non-existent
		Policies discouraging car ownership and promoting public transport and car sharing	Number of policies adopted
	Financial Incentives	EE Fund	Established by law; sources of financing are clear; disbursement procedure is clear; fund is operational
		Internal tax benefits	Number of tax incentives
		Customs duty for CFL and LED bulbs	Customs rate percentage
		Customs duty for solar water heaters	Customs rate percentage
Institutional Capacity	EE Institutions	Designated EE units within ministries	Presence of designated EE unit; adequacy of technical and human resources; capacity to formulate and monitor EE policies
		Designated EE agency	Presence of designated EE agency; adequacy of technical and human resources; capacity to implement EE policies
	Implementation Capacity	Number of EE buildings built	Percentage of new building stock built according to EE regulations
		Number of demonstration projects	Expert assessment from 0 to 10 based on number of demonstration projects; market size of construction industry
		Corruption Perception Index	CPI score
	Monitoring and Evaluation		
Utility	Power Generation	Power generation efficiency	National average percentage
		Share of renewable energy in generation mix	Percentage of total installed capacity
	Transmission and Distribution	Transmission and distribution losses (including technical and commercial losses)	National average percentage

AFEX Energy Efficiency (EE) is constructed in accordance with the OECD methodology for constructing composite indicators (OECD, 2008). A detailed description of methodology is presented in **Annex A**. The monitoring and evaluation factor is highlighted above in grey since it has not been assessed in AFEX EE 2015 due to a lack of data. It will be included in the next edition.

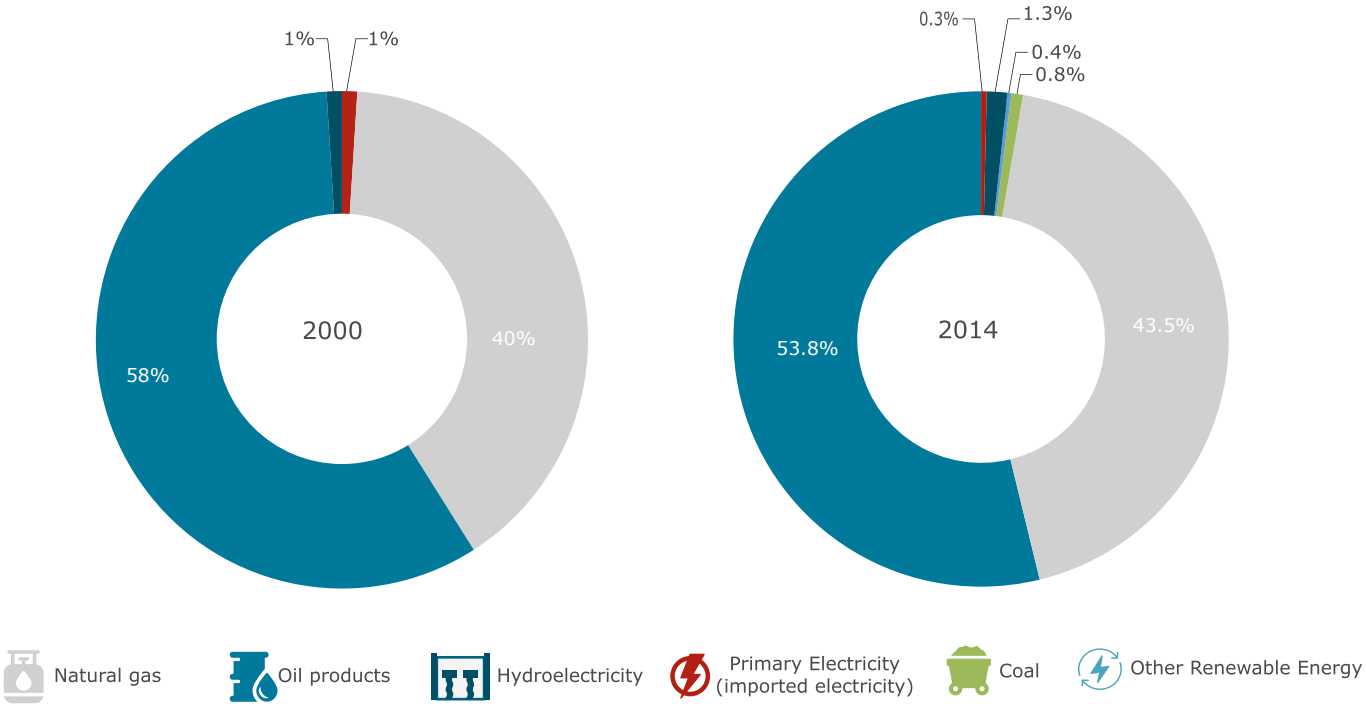

Transmission and Distribution
Generation
Utility
Electricity Price Structure
Energy Subsidies
Energy Pricing
EE Institutions
Implementation Capacity
Monitoring and Evaluation
Institutional Capacity
Energy Planning
Regulatory Framework
Financial Incentives
Policy Framework

1.5 Regional Overview of the Energy Efficiency

1.5.1. Primary Energy Consumption

Primary energy consumption covers usage by the energy sector, losses during transformation and distribution of energy, and final energy and non-energy consumption by end users. Figure 1 shows primary energy consumption in 20 Arab states and clearly demonstrates that the Arab region is still dominated by fossil fuels, which constitute around 98% of total primary energy consumption. Oil accounts for 53.8% of total primary energy use in the region, which is only a 7.2% decrease from the year 2000. However, the use of natural gas as a primary energy source has increased by 8.7% since 2000, totaling 43.5% of regional primary energy consumption in 2014. There are several reasons for the increasing reliance on natural gas: it has a higher thermal capacity, releases fewer emissions when burnt, relatively low cost, and it is abundant in the Arab region, which has around 29% of the world's gas reserves (BP, 2016). The use of natural gas in the electricity generation sector and as a primary fuel source in the cement and iron industries has also increased significantly, replacing the share that oil previously occupied as the primary source of energy. Renewable energy plays a minor role in primary energy consumption, contributing a total of 1.7%, of which hydroelectricity makes up about 1.33%. The total primary energy consumption in the region increased from 411 Mtoe in 2000 to 531 Mtoe in 2005, and finally to 767 Mtoe in 2014; using the year 2000 as a baseline, this is an increase of 29% and 86.6% for 2005 and 2014, respectively (BP, 2016), (EIA, 2016).

Figure 1: Primary Energy Consumption of 20 Arab States (2000 and 2014)



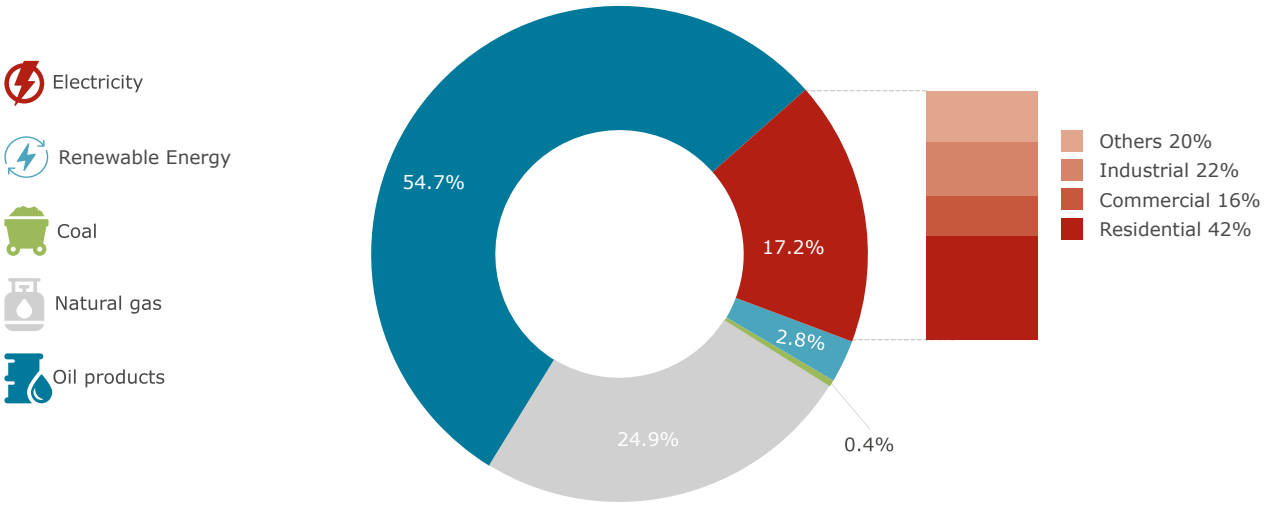
Source: RCREEE based on national sources and BP Statistical Review of World Energy

1.5.2. Final Energy Consumption

Figure 2 illustrates the total final energy consumption in twenty Arab states and the total energy consumed by end users (for example, households, industry, and agriculture), excluding energy used by the energy sector itself. Oil amounts to 54.7% of total final energy consumption, demonstrating that most oil is consumed in the transport, residential, and non-energy sectors[1]. Conversely, natural gas constitutes only 24.9% of the final energy consumption, indicating that a large portion of natural gas is consumed in the electricity and power sectors. Electricity accounts for only 17.2% of final energy consumption in the region, of which the residential sector alone consumes 42% of total electricity, and the industrial and commercial sectors consume 22% and 16%, respectively. Overall, electricity consumption in the Arab region has a growth rate of 6.32%/year.

Both Figures 1 and 2 show that the Arab region still mainly relies on fossil fuels for primary and final energy consumption. This high reliance on non-renewable energy sources means that greenhouse gases, air pollutants, and other environmental impacts related to energy use remain high in the region, with an existing 5.32% annual increase in carbon dioxide emissions (World Bank, 2012), (Globalcarbonatlas, 2016). Such a trend is in contrast with many governmental initiatives to reduce energy related environmental impacts, which makes it challenging for the region to adhere to the international community's common emission reduction commitments. There are many opportunities in the region to reduce energy consumption, as well as invest in energy efficient technologies and renewable energy that can both reduce governments' energy bills and the region's carbon footprint.

Figure 2: Regional Final Energy Consumption



Source: BP and Arab Union of Electricity

[1]The non-energy sector is defined as the sector where fuel (coal, oil and gas) is not combusted (not burned) by end-users, rather used for its chemical and physical properties rather than for its energy content (ie. petrochemical industry)

1.6. Energy Intensity and Economic Decoupling

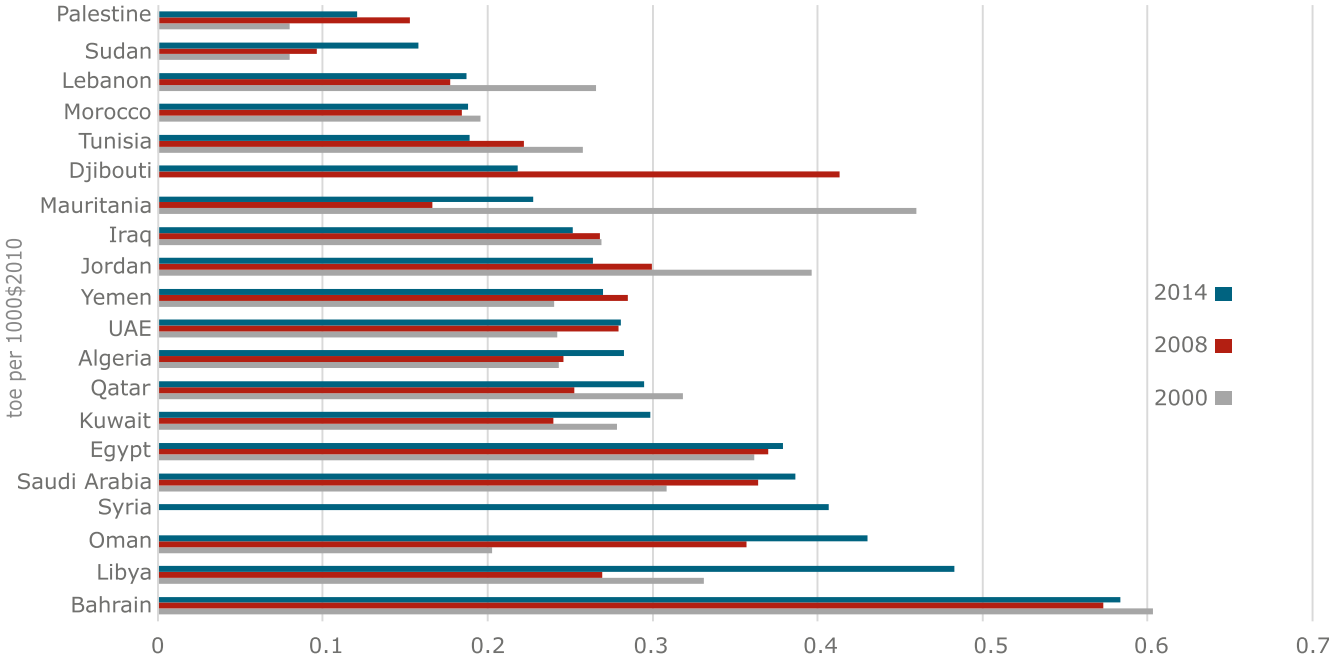
1.6.1. Primary Energy Intensity

Primary energy intensity is an energy efficiency indicator that represents the amount of primary energy required to produce a unit of GDP, or in this case, the amount of energy required to produce 1000$ of GDP. This indicator mainly reflects the degree of energy efficiency in a country's economy; lower numbers indicate countries with more efficient use of energy or, in other terms, requiring less energy to produce one unit of GDP.

Figure 3 shows an increasing trend in the primary energy intensity in some countries between 2000 and 2014 (i.e. Algeria, Libya, Oman, Saudi Arabia, and Sudan) while in other countries it is clearly decreasing during that same period (i.e. Jordan, Lebanon, Morocco, and Tunisia).

It should, however, be noted that due to the recent political instabilities in countries such as Syria, Iraq, Libya, and Yemen, the most accurate energy intensities of these countries could not be presented due to unreliable or inaccurate values in both the GDP and energy consumption.

Figure 3: Primary and Final Energy Intensity of 20 Arab Countries



The energy intensity indicator might not be the most accurate reflection of a country's energy efficiency performance because it is affected by many other non-energy factors such as: climate, geography, travel distance, home size, economic structure, population growth and level of economy. For example, countries like Kuwait, Qatar, Oman, and UAE have a higher GDP growth compared to energy consumption, the highest income per capita, and the highest energy subsidies expenditure that result in significantly lower energy prices (See Figure 4 and Annex 1).

Both Figures 4 and Annex 1 clearly demonstrate that countries with the lowest energy prices and highest incomes per capita (higher standard of living) have the highest primary energy and electricity consumption per capita. This suggests the main causes for energy and electricity consumption per capita include energy price (affected by taxation and subsidies), as well as income per capita and climatic conditions. As such, increasing the prices of energy by reallocating and reforming the energy subsidy system might help promote energy efficiency practices. Finally, it is important to note that GCC countries such as Kuwait, Qatar, Saudi Arabia, and the UAE hold the highest regional levels of greenhouse gas (GHG) emissions per capita, with Qatar emitting the highest worldwide in 2013 at 37.8 metric tons/capita. Likewise, Kuwait, Bahrain, UAE, and Saudi Arabia recorded 27.2, 24.3, 18.8 and 17.1 metric tons/capita of GHG emissions in 2013 compared to a world emission of 5 metric tons/capita (World Bank, 2016). As the energy mix of these countries is almost completely based on fossil fuels, it is clear that the high levels of energy intensity in the GCC region are translated into extremely high levels of GHG emissions.

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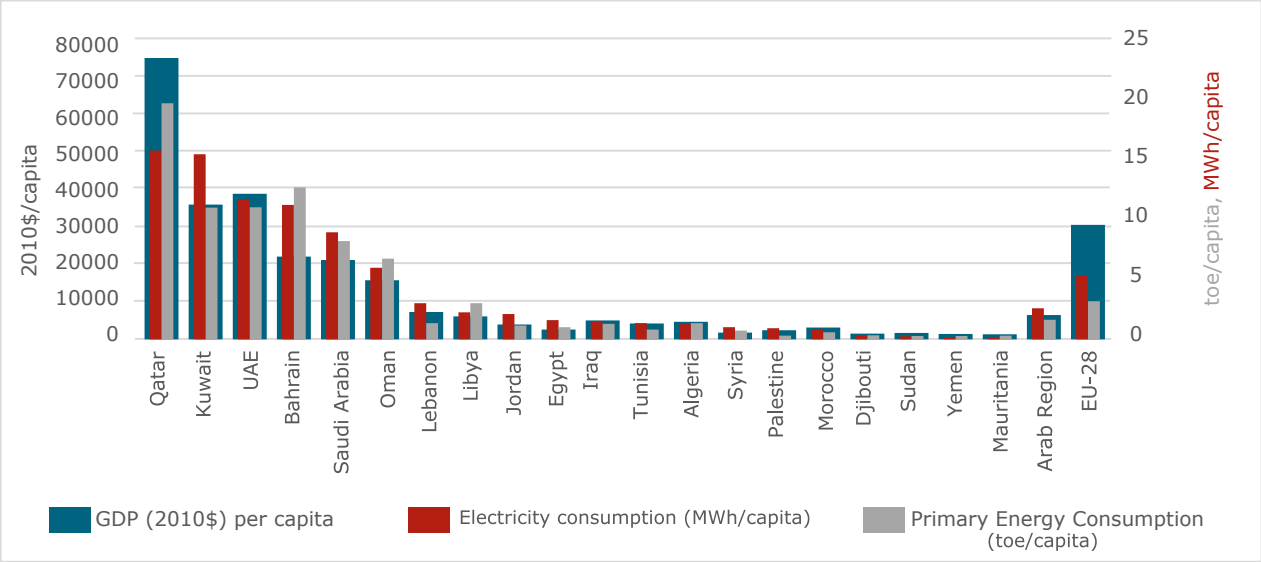
Figure 4: Trend in primary energy consumption, electricity consumption, and GDP in the Arab region



1.6.2. Economic Decoupling

Economic decoupling is an indicator of resource productivity – the ability to "do more with less." At the state level, it refers to an economy's ability to grow (increase GDP) without generating an equivalent increase in the use of natural resources (such as energy, materials, water and land). Thus the same level of economic prosperity is maintained, while the impact on the environment and natural resources is reduced. The OECD was the first international body to adopt the concept, defining it as breaking the link between "environmental bads" and "economic goods" (OECD, 2002). In the context of AFEX EE, decoupling refers to a maintained level of economic growth combined with a lower consumption of energy.

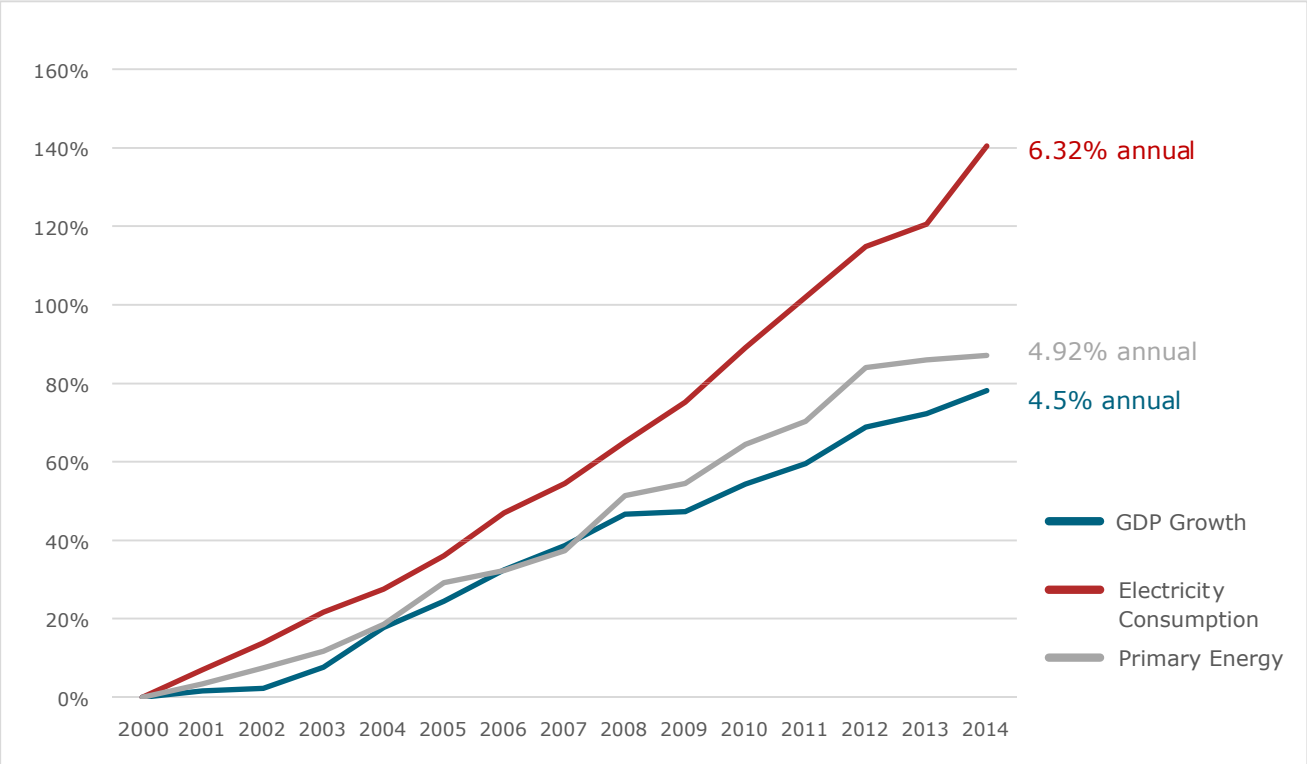
Figure 5 does not indicate any sign of decoupling between economic growth and energy or electricity consumption in the Arab region. Conversely, these figures show that the Arab region is facing rapid growth in electricity consumption, with a 6.32% annual growth in 2014, compared to an annual growth rate of 4.92% and 4.5% of primary energy consumption and GDP respectively. Furthermore, electricity consumption has grown by almost 89% over the last decade, which is 37% more than GDP growth during the same time period. This indicates poor practices in energy efficiency, especially in the residential sector, as it is responsible for 41% of total electricity consumption in the region.

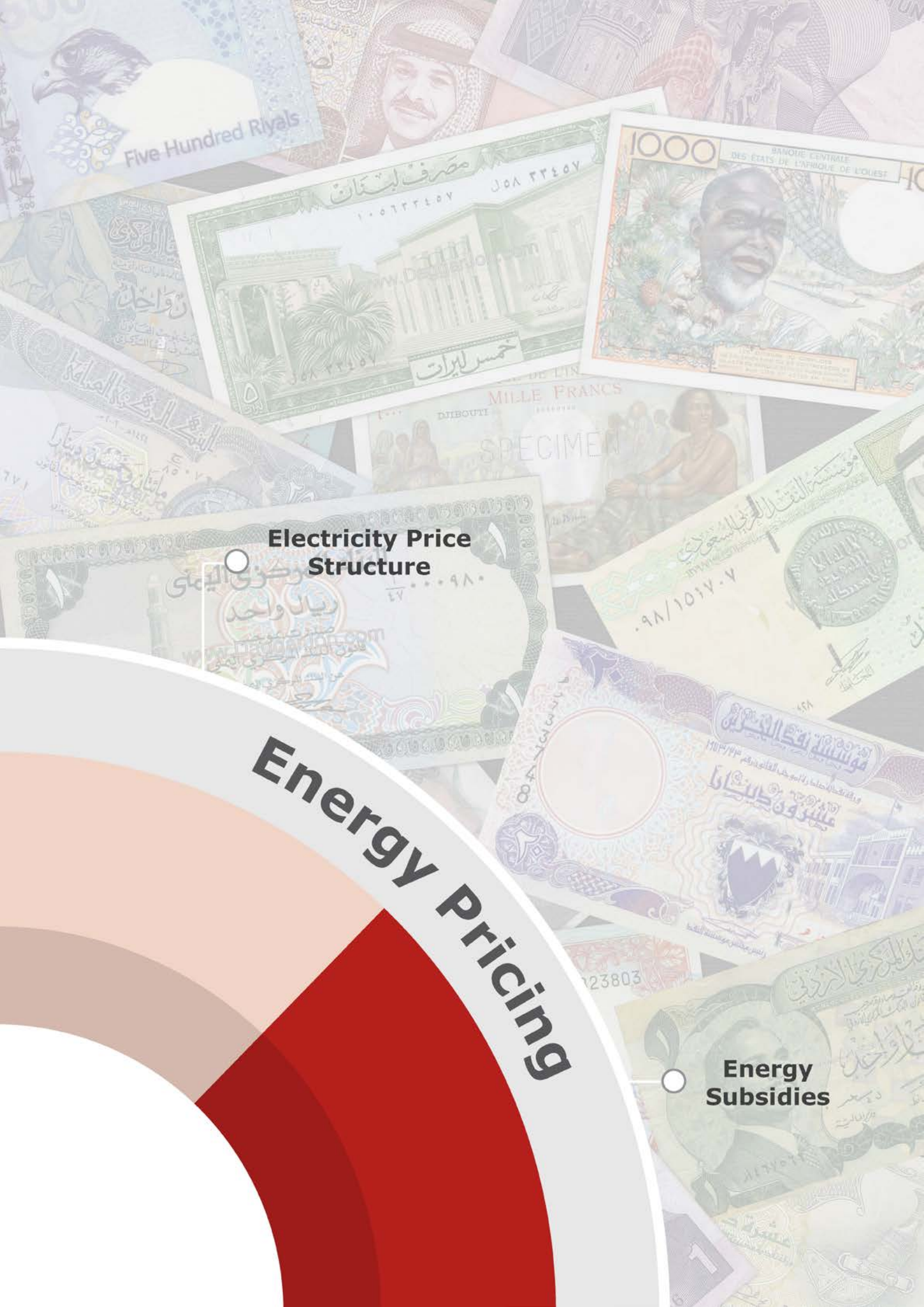
The GCC region is responsible for almost 58% of the total electricity consumption in the Arab region, which reflects a highly subsidized energy system that results in low energy prices , weather conditions and a high income per capita, as discussed above. The high electricity consumption in Egypt, which accounts for 16% of the Arab region's total electricity consumption, is mainly due to two factors: the huge expenditure on energy subsidies that accounted for around 16.64% of the country's 2013 GDP (according to IMF) and its large population of nearly 89.6 million people in 2014 (the 15th largest population in the world). The lack of decoupling between economic growth and energy consumption in the region underscores the necessity of investing in more energy efficient practices and technologies in order to reduce the amount of primary energy and electricity input needed to generate economic growth.

Achieving economic decoupling is essential, especially in the fossil fuel dependent Arab region, in order to reduce each country's carbon footprint and environmental impact, as well as decrease the region's dependency on energy related exports for economic growth. In order to achieve energy security, while maintaining economic development with lower carbon footprints, the region must invest more in renewable energy and energy efficiency practices and technologies.

Although the region in general does not show any sign of economic decoupling between growth in GDP and electricity consumption, it is important to note that GDP is not the only driver for the region's fast growth in electricity consumption. As most of the Arab region is still part of the developing world, other variables such as population growth, electrification rates and energy access, standard of living, and infrastructure are still growing at a fast rate and driving a similar growth in electricity consumption, without prompting a significant growth in GDP.

Figure 5: Decoupling of Energy Consumption from Economic Growth (2000 to 2014)




Electricity Price Structure
Energy Pricing
Energy Subsidies

2. Energy Pricing

The first category in the energy efficiency assessment is the energy pricing structure of each country. The Energy Pricing category assesses the level of demand for EE services in the Arab states. This category consists of two factors: (1) energy subsidies; and (2) electricity price structure. As illustrated in Table 2, these factors are further measured using seven quantitative indicators: electricity subsidies in the commercial, residential, and industrial sectors; subsidies for gasoline and diesel, as well as time of use price structure and other price based initiatives for electricity price structures.

Table 2: Energy Pricing Indicators

Category	Factors	Indicator	Score/Measuring Unit
Energy Pricing	Energy Subsidies	Electricity subsidies in the residential sector	Subsidy percentage (benchmarked to Palestinian retail prices for electricity)
		Electricity subsidies in the industrial sector	Subsidy percentage (benchmarked to Palestinian retail prices for electricity)
		Electricity subsidies in the commercial sector	Subsidy percentage (benchmarked to Palestinian retail prices for electricity)
		Subsidies for gasoline	Retail price per liter
		Subsidies for diesel	Retail price per liter
	Electricity Price Structure	Time of use price structure	Number of segments
		Other price-based incentives	Number of price incentives

2.1. Energy Subsidies

Energy subsidies remain a significant barrier for end user energy efficiency investments in the Arab region, as the region holds 43% of proven oil reserves and 29% of proven gas reserves. Most Arab countries, however, are adopting strategies and reforms to reduce energy subsidies in order to achieve energy security and reduce budget deficits, due to the recent plunges in oil prices (reaching $26/ barrel in February 2016) and the decrease in electricity prices from renewable sources. Pre-tax energy subsidies in the Arab region, which account for 31% of energy subsidies in the world in 2013, have dropped from $168 billion in 2013 to almost $92 billion in 2015 (IMF, 2015).

Oil and Gas Exporting Countries

Energy subsidies are extensively used throughout the Arab region, particularly in oil and gas exporting countries, such as Algeria, Kuwait, Saudi Arabia, and Qatar. The cost of energy subsidies in many other countries has increased along with social demands, industrialization, and living costs that resulted in significantly lower energy prices, when compared to international prices. Low energy prices present a barrier to the development of energy efficiency practices, which makes people less compelled to reduce energy consumption. This has caused the Arab regions to have some of the highest consumption of electricity per capita in the world, reaching 19,347 kWh/capita and 15,332 kWh/capita in Qatar and Kuwait, respectively (AUE, 2015).

Post tax energy subsidies in the GCC alone accounted for 13.08% of their GDPs in 2013 and 10% of their GDP in 2015; petroleum products account for two thirds of the energy subsidies, whereas electricity and gas only make up one third of the subsidies. Nonetheless, the recent plunges in oil prices, ranging between $37- $60/barrel in 2015, led to a staggering fiscal deficit of $153 billion in 2016 in the GCC, which is an increase from their $119 billion deficit in 2015 (Gulf news, 2017). Together, with the current conflicts in Iraq, Syria, Libya, and Yemen, oil exporting countries are undertaking various energy reform mechanisms to increase oil prices, and cut their deficit short.

Energy Importing Countries

Energy subsidy reforms are particularly important for energy importing countries, such as Jordan, Lebanon, Morocco, Tunisia and others, where low energy prices present a unique opportunity to reduce subsidies on energy, without severe price increases that may cause public unrest. Post-tax subsidies in oil importing countries, including Djibouti, Egypt, Jordan, Lebanon, Mauritania, Morocco, Sudan, and Tunisia accounted for an average of 6.7% of their GDPs in 2013. Nonetheless, these post-tax subsidies in 2013 were as high as 16.64%, 10.53%, and 11.23% of the GDPs in Egypt, Jordan, and Lebanon, respectively (IMF, 2015). Reforms in energy importing countries' subsidy systems are crucial in avoiding additional fiscal deficits and crises in these countries. Subsidy reform, or reallocation of subsidies, is of particular importance in energy importing countries in order to boost economic growth and develop human capital. Energy subsidy reforms are not being implemented in a significant and expedient manner, nonetheless, several countries such as Jordan, Egypt, Mauritania, Morocco, Tunisia, and Sudan, have started implementing measures to reduce spending on energy subsidies and increase the prices of electricity and fuel. Post tax energy subsidies expenditure in these countries dropped from an average of 6.67% of their GDPs in 2013 to 4.8% of their GDPs in 2015 (IMF, 2015). Egypt, Jordan and Lebanon for example reduced there energy subsidies to 9.98%, 3.62% and 10.32% of their GDPs respectively in 2015.

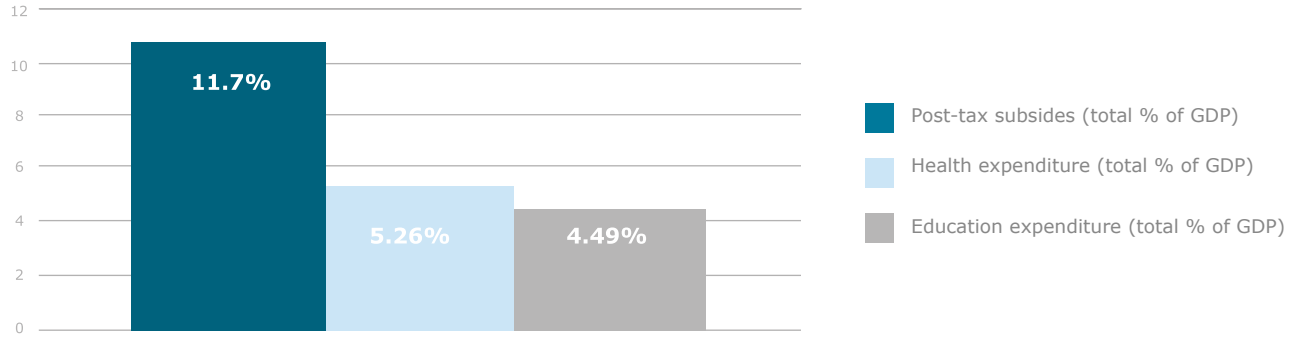
Opportunities for Subsidy Reforms

The fall of oil prices in June 2014, which eventually saw oil drop to $26 in February 2016, spurred GCC countries to mitigate revenue losses by increasing oil production. Budget deficits accounted for 15.7% of the total GDP in Algeria in 2016 (World Bank, 2016) and almost $272 billion in the GCC between 2015 and 2016. Although the price of oil periodically recovered, it remained well below $50 per barrel and is not expected to recover any time soon.

These drops in oil prices present a unique opportunity for both oil exporting and importing countries to reform their energy subsidy systems and replace them with incentives or policies that would benefit the poor in a more effective way, as well as encourage investments in renewable energy and energy efficiency projects. The Arab region accounted for almost 28% of the world energy subsidies in 2015 based on pre-tax subsidy prices (IMF, 2015). Energy subsidies in oil importing countries accounted for a substantial portion of their GDPs in 2015. The Arab region spent a total of $168 billion on pre-tax energy subsidies in 2013: GCC countries alone spent $106 billion and Egypt, Algeria, Libya, Morocco, and Tunisia spent more than $53.5 billion on energy subsidies (IMF, 2015). This expense is significantly more than what Arab countries spend on subsidizing healthcare and education. Nonetheless, subsidy reforms are slowly being implemented in the Arab region, namely in the oil importing countries that are less able to afford financing energy subsidies.

Low oil prices present an opportunity for governments to reduce expenditures on energy subsidies without causing a significant increase in the energy prices that would initiate a public backlash. Reducing energy subsidies allows governments to both reallocate resources to other sectors - such as education, food, health, and public transportation - or change subsidy distribution methods and policies so that resources can benefit poor communities efficiently through policies such as targeted cash transfers. Countries in the Arab region spend relatively low portions of their GDP on the education and health sectors. For example, in 2011, Lebanon spent only 1.6% of its GDP and in 2008 Egypt and Saudi Arabia spent 3.8% and 5.1% of their GDP on education (World Bank, 2012) respectively. Similarly, Syria, Saudi Arabia, UAE, and Morocco have spent 3.3%, 4.7%, 3.6%, and 5.9% of their GDP, respectively on healthcare (World Bank, 2014). As seen in Figure 6, Arab countries' expenditures on energy subsidies far exceed their expenditures on i.e. both healthcare and education. Presently, a great opportunity exists to transfer these subsidies from the energy sector to the health and educational sectors, which would better benefit civil society as a whole. Furthermore, subsidy reforms will improve energy efficiency, decrease the rapidly increasing energy consumption growth rate, and make the region less dependent on fossil fuels. Such actions will promote energy efficient practices and investments, assure an energy secure future, and work toward climate change mitigation by reducing the increase of CO_2 emissions.

Figure 6: Subsidies expenditure as % of GDP, 2013



2.2. Electricity

Estimating the exact amount of subsidies in the electricity sector is challenging due to complex subsidy modalities, poor data quality, and lack of transparency (IMF, 2014a; RCREEE, 2013). The 2015 edition of AFEX Energy Efficiency introduced a method to provide an estimate of implied subsidies in the electricity sector based on the price-gap approach. This method uses Palestine's, Mauritania's, and Morocco's retail electricity tariffs as a reference price for the residential, commercial and industrial sectors respectively. The electricity prices in these three countries are close to market price and represent the approximate true retail cost, making them ideal baselines. The goal of this method is not to calculate the exact amount of subsidies, but rather to provide a general idea of the magnitude of subsidies in the electricity sector.

Arab countries spent a combined 1.83% of their GDPs on post-tax electricity subsidies in 2013, which decreased to 0.99% of their GDPs in 2015 (IMF, 2016). Figures 7, 8, and 9 illustrate implied pre-tax subsidies in the residential, commercial and industrial sectors. These figures are based on an estimation of the average monthly electricity consumption by different segments of consumers in 20 Arab countries. The average consumption for residential customers is set at 500 kWh per month, 1,500 kWh per month for commercial customers, and 30,000 kWh per month for industrial customers. Furthermore, the electricity prices illustrated in the industrial sector (see Figure 9) present the average prices for low, medium, and high voltage customers during off-peak periods. It is important to note these prices might not indicate the final consumer price of a kWh of electricity consumed, because prices are also subjected to taxation according to each country's taxation system. Moreover, the figures presented show only differences in prices between countries at certain levels of consumption; they do not represent the actual prices paid by different consumers, as electricity tariff rates often vary depending on the voltage and level of consumption. For example, residential electricity tariffs in Egypt range from 11 piasters per kWh for customers with consumption levels below 50 kWh per month to 95 piasters per kWh for customers with consumption levels above 1,000 kWh per month. Finally, electricity production cost is subjected to various factors that might differ between countries, such as the type of fuel and power plant used for electricity generation, energy losses in transmission and distribution lines, availability of a regulatory body, and weather conditions. The electricity prices indicated in all three figures are presented in US cents per kWh and are based on the January 1st, 2016 exchange rates in each country.

Figure 7: Residential Electricity Prices and Subsidies Benchmarked to Palestine (2017)

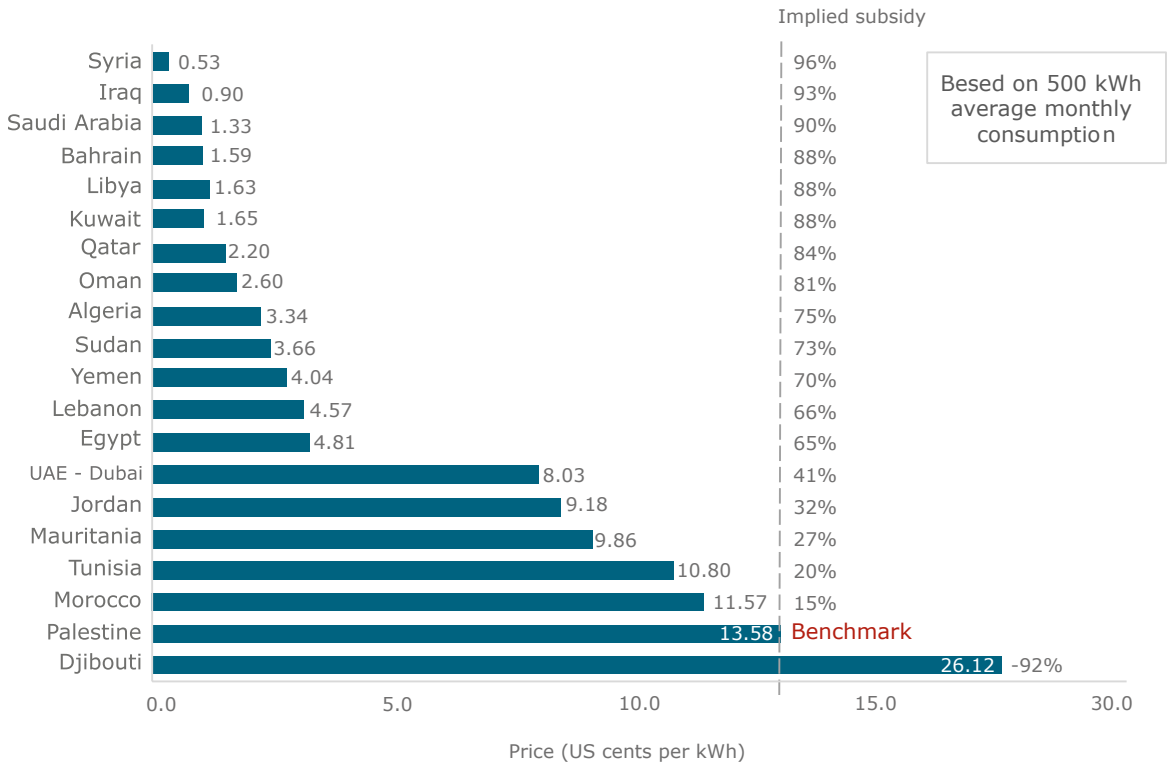


Figure 8: Commercial Electricity Prices and Subsidies Benchmarked to Mauritania (2017)

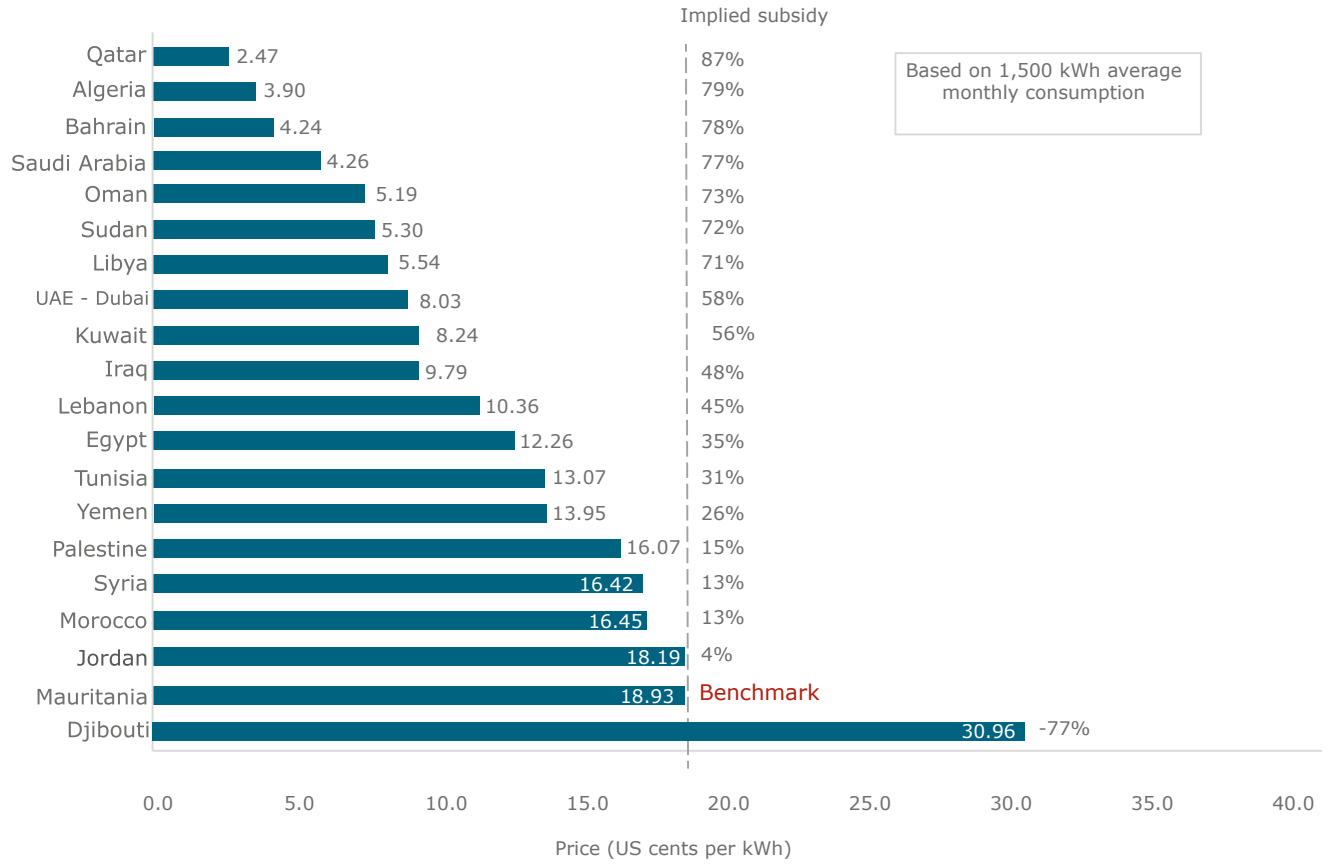
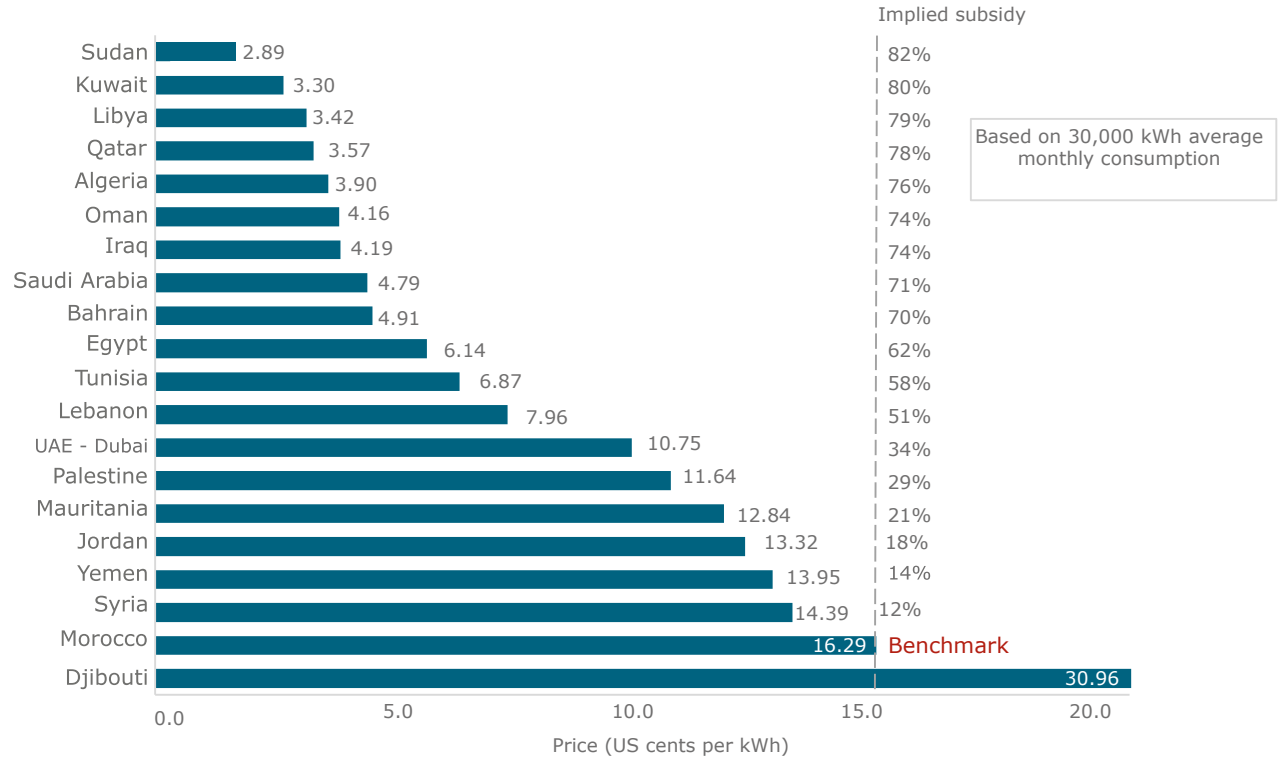


Figure 9: Industrial Electricity Prices and Subsidies Benchmarked to Morocco (2017)



Comparing the electricity prices in 2014 (AFEX Energy Efficiency 2015) and the electricity prices at the start of 2017, it is clear that the residential sector is still the most subsidized sector in the region. Electricity prices in the residential sector have mainly stayed the same with increases occurring mostly in Egypt, Syria, and for expatriates in Bahrain.

Nonetheless, we notice a significant increase in electricity prices for both the industrial and commercial sectors in the region in the past two years, which indicates that most Arab states have undertaken reform steps to reduce energy sector subsidies. Electricity in the GCC countries, with the exception of the UAE, remain the most subsidized in the region, with prices in Kuwait reaching as low as 0.3 US cents per kWh for the industrial sector and 0.7 US cents per kWh for the residential and commercial sectors. On the other hand, electricity prices in Morocco, Jordan, Mauritania, and Palestine remain the highest in the region. As of January 1st, 2017 the Syrian government issued a new electricity tariff (decree number 1670, issued December 26, 2016), that more than doubled electricity prices in the residential sector and increased electricity prices by more than five times in the commercial and industrial sectors (In local currency). Furthermore, electricity prices in Egypt increased two-fold for the domestic and industrial sectors from their 2014 prices, while the prices for commercial sector increased by almost 25% (In local currency). Although most regional oil exporting countries witnessed a large fiscal deficit due to low oil prices (for example, 12.5% of the GDPs in the Arabian Gulf in 2016 and 15% of the GDP in Algeria in 2015), electricity prices in these countries remain the lowest in the region. Compared to European average electricity prices of 22 US cents/kWh in the residential sector (33 US cents/kWh in Denmark and 32 US cents/kWh in Germany) and 13 US cents/kWh in the industrial sector, most Arab countries still have a long way to go in terms of subsidy reform (Eurostat, 2016).

2.3. Electricity Subsidy Reform Efforts

While subsidies continue to impact electricity pricing in the region, several Arab countries have initiated subsidy reforms so that electricity prices better reflect the true cost of production. Details of such reforms in Bahrain, Egypt, Kuwait, Oman, Syria, Tunisia, and the UAE are presented in Table 3. The general trend in regional electricity subsidy reforms is to increase electricity tariffs and electricity prices for residential and non-residential consumers. Egypt, for example, has a five-year plan to reduce its energy subsidies budget by increasing electricity tariffs by 10% to 15% in July 2014, with the overall goal to decrease energy subsidies by 50% in 2020, and remove them completely by 2025.

Table 3: Electricity Subsidy Reform[2]

Country	Electricity Reform
Bahrain	• Residential electricity prices increased for non bahraini subscribers and for bahraini subscribers having more than one account by 3 Fils/kWh for each of the three tariff categories in March 2016 • Electricity prices increased for the non-residential consumers by 81.25% for the consumption category above 500,000 kWh and by 31% for the category between 250,000 kWh and 500,000 kWh
Egypt	• As of July 2014, Egypt began increasing its electricity tariffs by 10 to 15% as part of the government's 5 year plan to remove energy subsidies by 2020. • Plans to cut the electricity subsidies by 6.4% to reach EGP 29 billion in 2017 • Electricity prices increased by 10% to 25% for large consumers in July 2015 • An electricity tariff was announced to increase residential sector prices by 40% in August 2016 • An increase in electricity prices for energy intensive industries by 21% to 23%
Kuwait	• The government passed a law in April 2016 to take effect after September 2017 that will increase electricity prices of expatriates living in Kuwait • The flat rate of 2 Fils/kWh changed to a block tariff of 3 tranches consisting of 5 Fils/kWh, 10 Fils/kWh and 15 Fils/kWh for consumptions between 0-1000 kWh, 1001 - 2000 kWh and above 2001 kWh, respectively • Electricity prices in the commercial sector increased to 25 Fils/kWh
Oman	• Introduced a new cost reflective tariff (CRT) that increased electricity prices in January 2017 for large industrial, commercial, and governmental consumers from the existing tariff of 20 Baisas per kWh for the commercial sector, 12-24 Baisas for the industrial sector, and 10-30 Baisas for the governmental sector to 26-30 Baisas/kWh for consumers who use more than 150 MWh per year saving around 100 million rials
Syria	• The domestic electricity prices in Syria more than doubled from their 2014 values, as of January 1st, 2017 • Industrial and commercial tariffs increased more than 5 times compared to their 2014 values
Tunisia	• Electricity tariffs were increased for medium and low voltage consumers by 10% each in January and May 2014 • Tunisia's 2017 budget projects an increase in electricity and gas prices, saving up to 175 million Dinar in energy subsidies
UAE	• Electricity prices for expatriates in Abu Dhabi will increase by 27.6% starting in January 2017 • Electricity prices will rise between 34% and 36.4% for UAE nationals in January 2017 • Payment for nationals will increase from 5 Fils/kWh to 6.7 Fils /kWh if their consumption rises above ADEWA "ideal consumption" of 400 kWh/day in villas and will pay from 5.5 Fils / kWh to 7.5 Fils / kWh if energy consumption rises above the standard of 30 kWh/day in flats

[2] Percentages refer to changes in local currency

Figure 10: Trend of electricity prices in the Arab region between 2014 and 2017

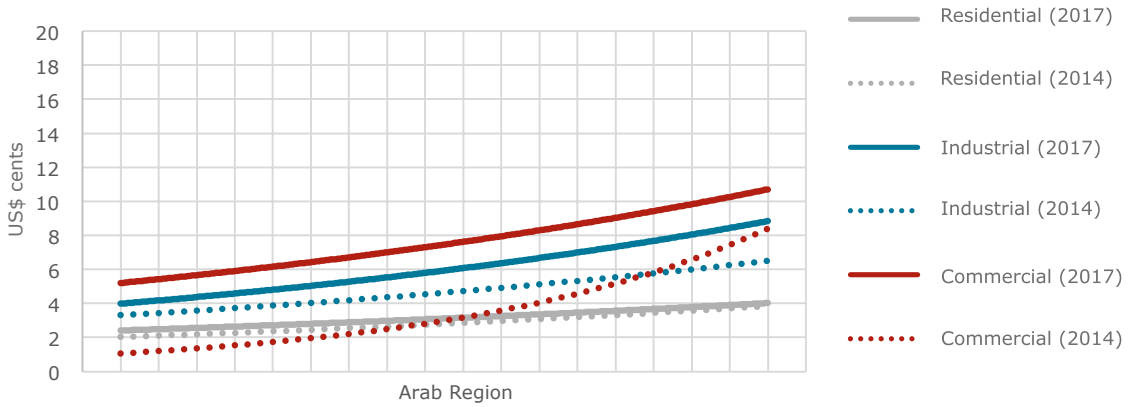


Figure 10 shows the trend-lines of the electricity prices in all three sectors (residential, commercial, and industrial) across the Arab region both in 2014 and the beginning of 2017. It is clear that, in general, most reforms in the region's electricity structure occurred in the commercial and industrial sectors, while the electricity prices in the residential sector remained relatively the same.

2.4. Diesel and Gasoline

Figures 11, 12, and 13 illustrate the retail prices of gasoline 95, gasoline 90, and diesel during the period of June and July 2016, which witnessed and average international oil price of $46.8/barrel. The highest prices for all three types of fuels are observed in Palestine, Mauritania, Syria, and Yemen. In Palestine, the prices are particularly high since they are tied to the Israeli energy prices, which are far higher than the global average prices of gasoline and diesel. Israeli retail fuel prices are the ninth highest in the world, according to available price data. In addition, Israel exercises exclusive rights over the supply of fuel, and Palestinians receive daily a specified quota, which has an additional impact on retail prices of fuel (GlobalPetrolPrices. com, 2014; Silver, 2012).

Figure 11: Retail Prices of Gasoline 90, 2016 (US$/liter)

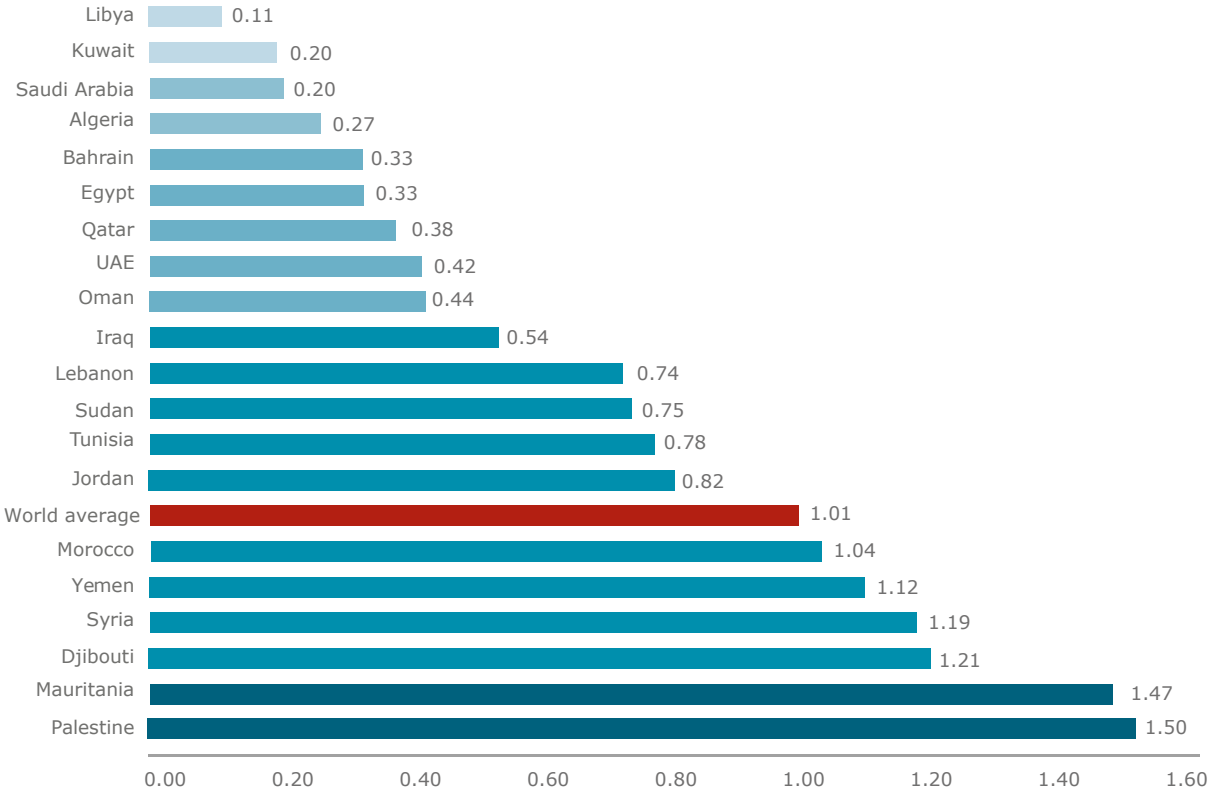


Figure 12: Retail Price of Gasoline 95 (US$/liter)

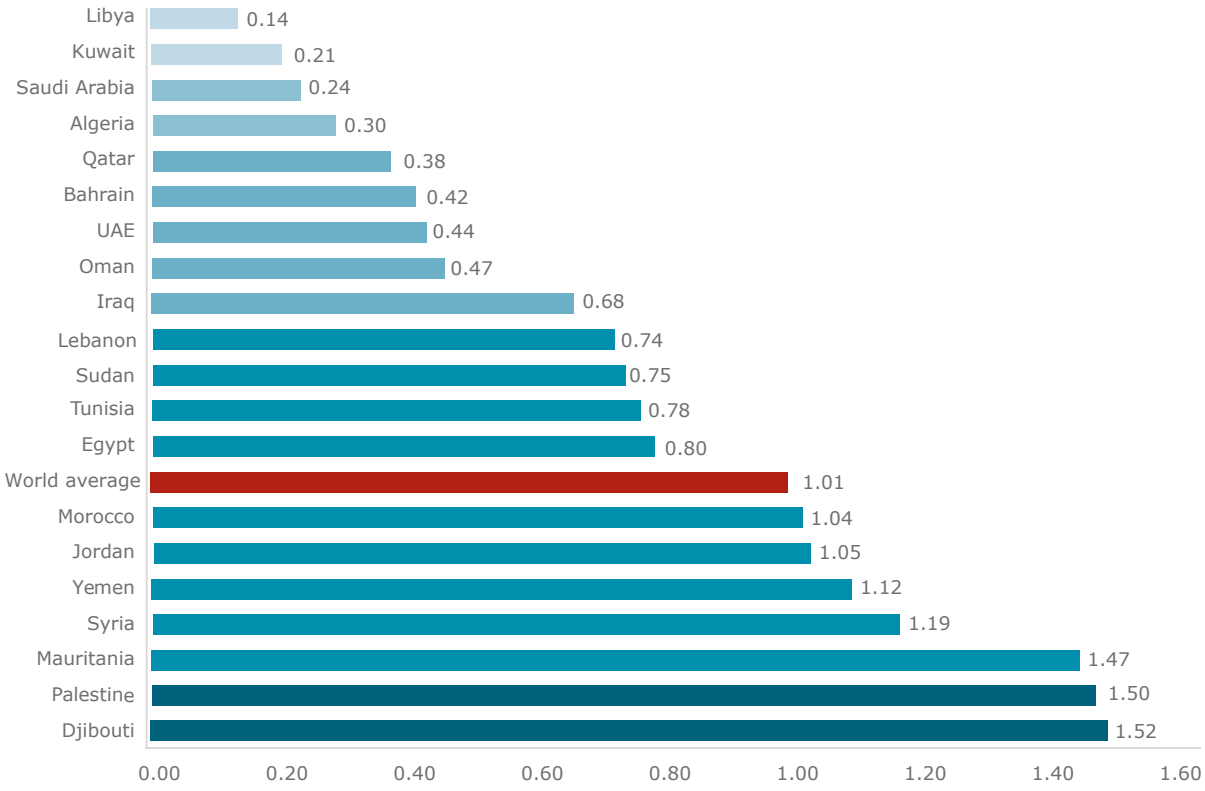
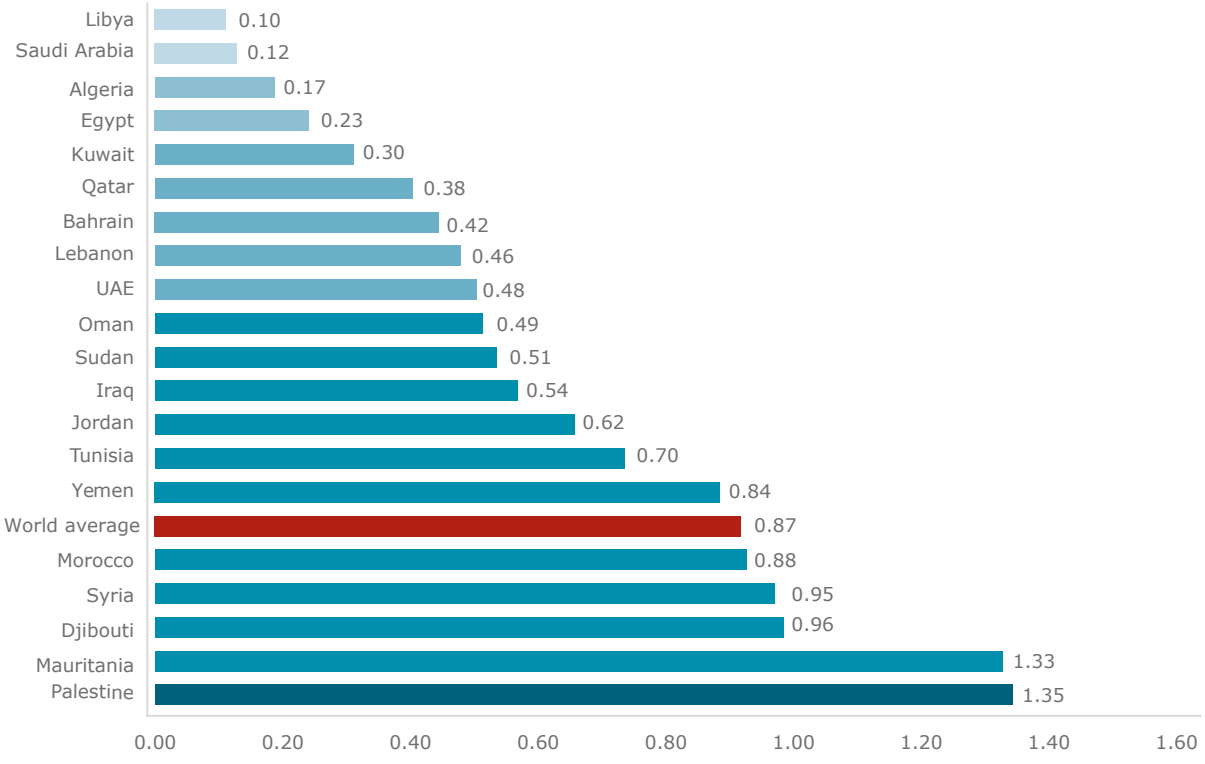


Figure 13: Retail Price of Diesel 2016 (US$/liter)



2.5. Fuel Subsidy Reform Efforts

Table 4 provides details on fuel subsidy and price reforms the Arab region. The international drop in oil prices in 2015 – 2016 has impacted regional fuel pricing, with many countries increasing gasoline and diesel prices to reduce price distortion. For example, Algeria, Bahrain, Egypt, Kuwait, Jordan, Morocco, Oman, Sudan, Tunisia, and the UAE have increased fuel prices, as is illustrated in Table 4. Building on successful subsidy reforms in 2014, Morocco and Tunisia have implemented additional subsidy reforms, shown in Table 4. In a particularly successful effort, Morocco liberalized all diesel and fuel prices in December 2015 in order to cut energy subsidy spending from $2.38 billion in 2015 to $1.61 billion in 2016, which is expected to reduce the fiscal deficit from 4.3% of GDP in 2015 to 3.5% in 2016 (El Yaakoubi, 2015). Likewise, the Egyptian government is planning on cutting its fuels subsidy budget by almost 43% in 2017, which will reduce subsidy spending from EGP 61 billion in 2015 to EGP 35 billion, which could result in EGP 8 - 10 billion in savings (Farouk, Alsharif and Popper, 2016).

Table 4: Fuel Subsidy Reform[3]:

Country	Fuel Reform
Algeria	• Algeria increased the gasoline and diesel prices from 2010 levels by around 34% in the beginning of 2016
Bahrain	• Octane 95 and Octane 91 prices were increased to 160 Fils/liter and 125 Fils/liter, which is a respective 33% and 22% increase from previous prices in January 2016
Egypt	• Octane 80 price increased by 46.8% from LE 1.6 to LE2.35 per liter in November 2016 • Octane 92 price increased by 34.6% from LE 2.6 to LE3.5 per liter in November 2016 • Diesel price increased by 30.5% from LE 1.8 to LE2.35 per liter in November 2016 • Small butane gas cylinder price rose from EGP 12.5 to EGP 15 and large gas cylinder price rose from EGP 25 to EGP 30. • Natural gas price rose from EGP 0.4 per cubic meter to reach EGP 0.75 per cubic meter • The Egyptian government is planning on cutting its fuel subsidies budget by almost 43% in 2017, due to low international petrol prices, and reduce subsidy spending from EGP61 billion in 2015 to EGP35 billion.
Jordan	• In October 2016, diesel and kerosene witnessed an increase in price from JD 0.425/liter to JD 0.435/liter in October 2016 • Unleaded 90-octane gasoline selling price rose from JD 0.555/liter to JD 0.575/liter and unleaded 95-octane gasoline price rose from JD 0.720/liter to JD 0.745/liter
Kuwait	• Diesel and kerosene prices rose by more than 50% in January 2015. • The price of low-octane petrol rose by 41% to 28 cents a liter, the price of high-grade petrol rose by 61% to 35 cents a liter, and the price of environmentally friendly "ultra" petrol rose by 83% to 55 cents a unit
Morocco	• Subsidies on industrial fuel and gasoline were eliminated in February 2014 and subsidies for industrial fuel used in electricity generation were also eliminated in June 2014 • Subsidies on diesel were totally eliminated in January 2015 • The government liberalized all diesel and fuel prices in December 2015 in order to reduce spending on energy subsidies from €2.1 billion in 2015 to € 1.4 billion in 2016, which is expected to reduce the fiscal deficit from 4.3% of the GDP in 2015 to 3.5% in 2016
Oman	• Fuel prices rose in October, 2016 by 7.8%, 8.3%, and 4% from August, 2016 levels for super grade gasoline, normal grade gasoline and diesel, respectively
Sudan	• The price of gasoline per gallon rose from SDG 21 to SDG 27.5 in November 2016 • The price of diesel per gallon rose from SDG 14 to SDG 18.8 in November 2016
Tunisia	• Energy subsidies were reduced by almost half to cement companies in January 2014 and were later eliminated in June 2014 • Gasoline prices increased by 6.4% and diesel prices rose by about 7% in July 2014
UAE	• The Octane 98, Octane 95, Octane 91 and Diesel prices increased by 20%, 21%, 22% and 12%, respectively in November 2016.

[3]Percentages refer to changes in local currency

Energy Efficiency as a Safety Net for Subsidy Reform

Energy sector subsidy reforms in the Arab region are crucial for economic and social development. Subsidies are national wealth sharing schemes that aim to improve the welfare of low income households (or nationals in the case of the GCC countries) and, as such, reforms must be effectively implemented as to minimize the potential impact on economically vulnerable groups of the population. In order to achieve this, a social protection system or social safety net must first be established. Such safety nets can include: direct welfare payments to households, changes in the structure of electricity tariffs, and the establishment of social programs. Energy efficiency is an additional key social and economic safety net in the energy subsidy reform strategy because it will ensure that in the absence of subsidies, low-income households can meet their energy needs without financial stress.

Reforming the energy subsidy system will lead to an increase in energy prices for residential consumers, resulting in less money to invest in other basic needs or items. However, energy efficiency creates social and economic protection for households and businesses by reducing their energy bills through a one-time investment, rather than monthly payments, thus being more economically viable in the long run. Investing in energy efficiency further improves social welfare through the development of a new market, creating badly-needed jobs in the region. Furthermore, environment and health, two major issues in the region, can be improved by promoting energy efficiency, as it curbs various air pollutants that would have been otherwise emitted by the high demand energy sector. Energy efficiency can be achieved through implementing properly designed and targeted conservation and demand management programs on the national level. Such programs can include implementation of National Energy Efficiency Action Plans, thermal insulation codes, mandatory energy labels on appliances and equipment, energy audits, rebates and coupons, minimum energy efficiency standards (MEPS), awareness campaigns to explain the benefits of energy efficiency to the population, energy efficiency funding programs, tax relief on EE equipment, and various other incentives. By gradually shifting portions of the country's energy subsidy budget towards incentives that promote end user energy efficiency, regional governments will improve the welfare of its citizens by lowering their expenditure on energy commodities and reduce the overall budget spent on subsidizing energy. State financial investments in EE will eventually draw additional private sector investments that will further the development of new energy efficiency markets, which will economically and socially benefit regional states.

2.6. Electricity Price Structure

2.6.1. Overview of Peak Demand

Almost all 20 Arab countries have witnessed an individual increase in electricity peak demand by more than 10% over the last three years (2013-2016). As seen in Table 5, between 2013 and 2016 Iraq, Sudan, UAE, and Qatar have the highest increases in peak demand, with respective increases of 64%, 39%, 36% and 24%. Conversely, Syria and Yemen have experienced declines of -31% and -3%, due to the recent conflicts in both countries. On average the region experienced a 21% increase in peak electricity demand from 2013 to 2016 and an over 129% increase from 2003 to 2016.

Table 5: Arab States Peak Electricity Demand (2003 to 2016)

Country	Peak demand 2003 (MW)	Peak demand 2013 (MW)	Peak demand 2016 (MW)	Change -2003 2016	Change -2013 2016
Algeria	5,206	10,464	12,839	147%	23%
Bahrain	1,535	2,917	3,418	123%	17%
Egypt	14,401	27,000	29,200	103%	8%
Iraq	7,372	14,527	23,775	223%	64%
Jordan	1,428	2,995	3,250	128%	9%
Kuwait	7,480	12,060	13,390	79%	11%
Lebanon	1,820	2,744	3,173*	74%	16%
Libya	3,381	6,520	6,520*	93%	0%
Morocco	2,977	5,580	6,050	103%	8%
Oman	-	-	5,920	-	
Palestine	210	1,082	1,340	538%	24%
Qatar	2,312	6,000	7,435	222%	24%
Saudi Arabia	26,272	53,864	60,828	132%	13%
Sudan	1,151	2,011	2,787	142%	39%
Syria	5,018	7,703	5,327	6%	-31%
Tunisia	2,010	3,144	3,400	69%	8%
UAE	9,603	16,798	22,782*	137%	36%
Yemen	577	1,358	1,312*	127%	-3%
Region	92,753	17,6767	21,2746	129%	21%

* Data from the year 2015
Source: AUE 2003 – 2016

Table 6 demonstrates that most Arab states experience electricity peak demands during the summer, except for Iraq, Jordan, Libya, Palestine, and Syria with electricity peak demand during the winter, due to the colder regional climate. In general, the Arab region experiences an electricity peak demand during the summer, because of the increase in the use of air conditioning, which is directly linked with climate change that further increases temperatures in the region.

Table 6: Arab States Peak Electricity Times

Winter Night Peak	Summer Night Peak	Summer Day Peak
Iraq	Egypt	Algeria
Iraq	*Lebanon	Bahrain
Libya	Morocco	Kuwait
Palestine		Qatar
Syria		Saudi Arabia
		Sudan
		Tunisia
		UAE
		Yemen
		*Yemen

* Data from the year 2015

In most Arab countries, the projected rate of electricity generation in 2020 is expected to grow in parallel with the growth in electricity demand. The regional percentage growth in electricity production is expected to exceed that of electricity demand in 2020 by between 0% and 1.3%; however, some countries, such as Saudi Arabia, Qatar, and Palestine, have an expected discrepancy between electricity production and demand of 2.9%, 5.6%, and 1.6%, respectively. However, Morocco, Algeria, Syria, and Tunisia are projected to have a higher rate in electricity demand growth compared to electricity generation in 2020, equal to 0.5%, 1.9%, 3.1%, and 3.4%, respectively. Nonetheless, all of the Arab states, with the exception of Lebanon, are projected to experience an increase in electricity demand above 20% between 2016 and 2020.

In Lebanon the state electricity company Electricité du Liban (EDL), responsible for the country's electricity generation and transmission and distribution, covers less than two third of the total electricity demand in the country. The remaining electricity demand is provided by privately owned generators running on heavy diesel oil that contribute to almost 32% of the total CO_2 emissions in the country (MOE, 2011). In rural areas of Lebanon electricity cut offs can last up to 16 hours a day. Lebanese citizens usually pay two electricity bills: one for the state electricity, which is heavily subsidized, and the other for private generators that can cost up to $100-$120 a month for only 5 ampere connection (Karam, 2016).

PEAK DEMAND

In most Arab countries, the projected rate of electricity generation in 2020 is expected to grow in parallel with the growth in electricity demand.

Kuwait experienced electricity cuts during peak summer electricity demands in July 2016 when electricity demand was higher than the country's actual generation capacity. Kuwait is thus looking at increasing its electricity generation capacity from the current 14 GW to 31 GW in 2030 by building new power plants that mostly run on natural gas. Furthermore, the Kuwaiti government is planning to build new liquefied natural gas import (LNG) terminals to import LNG in order to meet the necessary demand for sufficient electricity production (Kuwait imports natural gas, 2016).

For many years, Iraq has experienced power cuts because electricity from the national grid is only supplied for a few hours a day, due to corruption and electricity generation shortages. This creates a significant problem for Iraqis, especially in the summer when temperatures reach up above 500C. GE has recently signed a $1.4 billion contract with the Ministry of Electricity to set up 1.75 GW of new power plants to the national grid (GE, 2017).

Due to the rapid increase in electricity demand in the region, various Arab countries are investing in nuclear power plant projects, which are expected become operational over the next few years. The United Arab Emirates is in the process of commissioning four nuclear power plants, with the first expected to come online in 2017 and the fourth in 2020. The four nuclear power plants are expected to generate 5.6 GW of electricity, around 25% of the country's total demand (World Nuclear, 2017). Saudi Arabia is planning to build 16 nuclear power plants with a total output of 17 GW by 2032. Jordan and Egypt are also among the countries investing in nuclear power and have signed deals with the Russian Federation national nuclear corporation (Rosatom) (Nakhle, 2016). Jordan has made a $10 billion investment to build two 1,000 MW nuclear power plants, which are expected to be operational by 2023 (World Nuclear, 2015). Egypt secured a $25 billion loan from Russia to build four nuclear reactors totaling 4,800 MW (1,200 MW each) over the next 12 years (Farag, 2016).

2.6.2. Time-differentiated Pricing

Electricity tariff structures vary between countries in the Arab region. There are three general types of tariffs used in the region: flat rate tariff, block rate tariff, and congestion or time of use tariff (TOU). Many of the Arab states apply a form of TOU electricity price structure for medium, high, and extra high voltage customers. These countries include Algeria, Egypt, Lebanon, Morocco, Jordan, and Tunisia. Jordan, for example, applies TOU to large and medium industries, hotels, and agriculture. Saudi Arabia employs TOU to small and large industries with digital meters and a seasonal tariff for small and large industries with electromechanical meters. Tunisia is the only Arab state that applies a TOU price structure for low voltage customers, mostly for irrigation purposes. Conversely, Bahrain, Iraq, Kuwait, Libya, Palestine, Qatar, Sudan, UAE, and Yemen use flat electricity rates. Table 7 provides details on the countries that apply TOU price structures.

Flat Rate Tariff:

Flat rate tariffs are applied when categories of consumers are charged at different fixed prices, independent of their energy consumption; in other words, the price of 1kWh remains the same regardless of the quantity of electricity consumed. This type of tariff might help certain industries produce more goods and services, as well as gain a competitive edge in international and local markets by reducing their electricity bills and risks associated with operating at peak load times. However, this type of tariff could lead to increased risks for the utility providers, as they could potentially be forced to sell expensive electricity at a loss during peak load times. Flat rate tariff might not always be the optimal solution because the uniform price might be higher than that of a block or time of use tariff, forcing industries or commercial businesses to reduce their final consumption. Furthermore, the flat rate tariff does not provide an incentive to end users to take advantage of low electricity cost periods. Flat rate tariffs are applied to industries in Sudan, Saudi Arabia, Lebanon, Palestine, Qatar, Libya, Yemen, and Kuwait

Block Rate Tariff:.

Block rate tariffs charge a certain rate for the first block of electricity consumed and all the succeeding blocks are charged at an increasing rate. Each block represents a fixed range of electricity consumption, which is charged at a fixed rate. Block tariffs are applied to residential customers in all of the Arab countries, as well as to commercial users with the exception of Oman, UAE, Libya, and Yemen where flat rate tariffs are used. This type of tariff encourages consumers to stay in the low tranche of the block tariff by reducing their electricity consumption and adopting more energy efficient appliances and practices.

Time of Use (TOU) Pricing or Congestion Pricing:

This type of tariff is measured based on both the time of day when electricity is used and the quantity of electricity consumed during that period, rather than the quantity of electricity consumed only. Electricity is most expensive during peak load times and least expensive during non-peak times. Electricity peak and non-peak times differ between countries, as they depend on various factors, such as the weather and the consumption behavior of residential consumers. Reducing residential and commercial sectors' electricity consumption during peak load periods is crucial, as it will reduce reliance on inefficient and expensive power plants, such as diesel and gas-fired power plants. This type of tariff aims to reduce electricity consumption during peak times by charging higher rates during that period. Egypt, Jordan, Morocco, Algeria, and Tunisia apply TOU tariff to their medium and high voltage customers, which are usually agriculture or industries. Lebanon and Oman apply TOU only for industries and it relies on a seasonal change basis rather than a day based one.

Table 7: Time-differentiated Rates for Electricity (2016)

Country	Customers	Time-differentiated Rates		
Algeria	High voltage customers	Peak	Full hours	Night
	Medium voltage customers			
Oman	Industrial	September-April	May-August	
	Commercial	Governmental		
	Residential, Governmental	Block tariff		
	Tourism			
	Agricultural, Fishery			
Iraq	Residential	Block tariff		
	Commercial			
	Industrial			
	Governmental			
	Agricultural			
Sudan	Residential	Block tariff		
	Industrial	Flat rate tariff		
	Governmental			
	Agricultural			
Saudi Arabia	Residential	Block tariff		
	Commercial			
	Agricultural, Charities			
	Industrial, Private educational facilities, Private medical facilities	Flat rate tariff		
	Governmental			
Egypt	Extra high voltage	On peak	Off peak	
	High voltage			
	Medium voltage			
	Low voltage	Flat rate tariff		
	Residential	Block tariff		
	Commercial			
	Customer service			
Bahrain	Residential	Block tariff		
	Non residential			
Lebanon	Residential, Low voltage commercial	Block tariff		
	Low voltage (Industrial, Agriculture)	Flat rate tariff		
	Medium voltage (Industrial, Agricultural)			
	High voltage			
	Industrial	Summer (April-September)	Winter (October-March)	

Country	Customers	Time-differentiated Rates		
Palestine	Residential, Places of worship	Block tariff,		Regional pricing
	Medium voltage	Flat rate tariff		
	Water pumping			
	Agriculture			
UAE (Abu Dhabi)	Residential (Flats, Villas)	Block tariff		
	Governmental	Flat rate tariff		
	Commercial			
	Agriculture, Fishery			
	Industrial (Below 1 MW)			
	Industrial (Over 1 MW)	On peak		Off peak
UAE (Dubai)	Residential	Block tariff (in addition to fuel surcharge cost)		
	Commercial			
	Industrial			
Qatar	Residential (Flats, Villas)	Block tariff		
	Commercial, Hotel			
	Industrial	Flat rate tariff		
	Productive Farms			
Jordan	Residential	Block tariff		
	Commercial			
	Telecommunication			
	Small industries			
	Medium and Large industries	On peak	Day load	Night load
	Agriculture			
	Hotels			
Libya	Residential	Block tariff		
	Commercial	Flat rate tariff		
	Agriculture			
	Industry (Small, Large)			
Mauritania	Residential	Block tariff		
	Commercial			
	Industrial			
	Administration	Flat rate tariff		
Morocco	Residential	Block tariff		
	Low voltage			
	Agriculture	Block tariff	Off peak	Full hours
	Extra High and High voltage	Winter		Summer
	Medium voltage			
Yemen	Residential	Block tariff		
	Commercial	Flat rate tariff		
	Industrial			

Country	Customers	Time-differentiated Rates			
Kuwait	Residential	Block tariff			
	Commercial	Flat rate tariff			
	Industrial				
	Agricultural				
Tunisia	Low tension	Block tariff			
	Low voltage irrigation	Day	Peak evening	Night	Peak morning summer
	High voltage				
	Medium agriculture irrigation	Day	Peak evening	Night	
Syria	High voltage	Day load	Night load	Evening peak	
	Medium voltage				
	Low voltage	Block tariff			

It is important to note that TOU price structures are most effective in reducing peak load energy consumption when electricity prices are sufficiently high enough to induce changes in consumption behavior while the power supply is uninterrupted. Due to these limitations, some countries in the region, such as Lebanon and Egypt, do not enjoy the full positive impact of their TOU price structures. In these countries, the current electricity system is unable to ensure sufficient uninterrupted power supply. Often blackouts occur in a sporadic manner, preventing industries from effectively planning their operational activities (Deghaili, 2013). Under such circumstances, a TOU price structure has almost no effect, as power is only periodically available during peak hours.

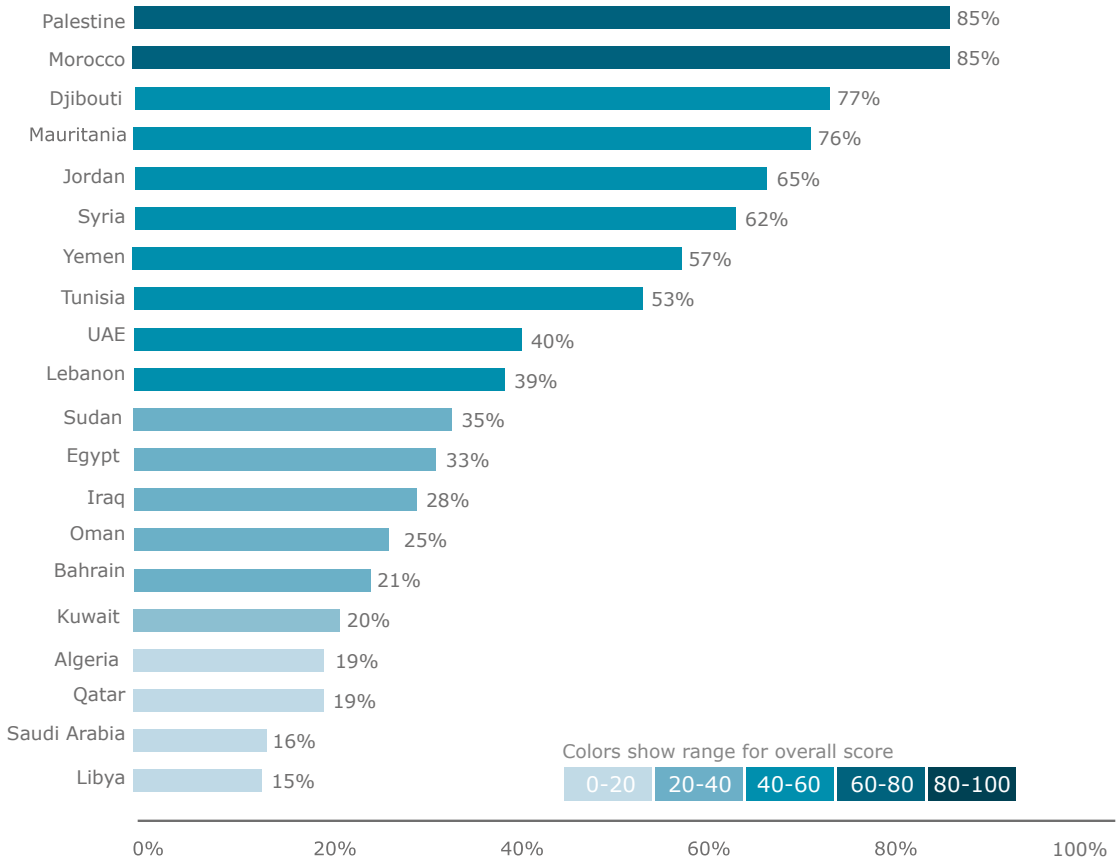
2.7. Energy Pricing Final Scores and Ranking

Each country's final scores and ranks in the Energy Pricing category are presented in Figure 14. Palestine and Morocco continue to lead the region in reducing energy subsidies, so that energy pricing more closely reflects market value. By removing or drastically reducing subsidies, regional countries will save a significant amount of their GDP normally spent on subsidies. Further, high energy prices promote and incentivize energy conservation.

Numerous regional countries have made great progress since 2015 in reducing energy subsidies, in part due to the recent drop in oil prices. Seven countries (Bahrain, Egypt, Kuwait, Oman, Syria, Tunisia, and the UAE) instituted reforms in electricity subsidies. While the reduction of subsidies is a positive step, Bahrain, Kuwait, and Oman still have some of the lowest prices in the region and should further cut subsidies in the future. Despite the rise in electricity prices in the region, Arab countries have considerably lower electricity prices in the residential sector, compared to the European average of 22 US cents/kWh. Djibouti is the only regional country to have residential energy prices higher or comparable with the European average. Accordingly, regional countries should focus on reducing electricity subsidies in the residential sectors. Several Arab countries, Jordan, Yemen, Syria, Morocco, and Djibouti, have similar or higher industrial electricity prices, compared to the European average (13 US cents / kWh).

Half of the countries in the region reduced fuel subsidies or increased tariffs, which resulted in an increase in petrol prices. These subsidy reductions have led Morocco, Yemen, Syria, Djibouti, Mauritania, and Palestine, to have gas prices above the world average for gasoline (Gasoline 90 and Gasoline 95 is 1.01 US cents / liter). Likewise, subsidy reform has led to an overall regional increase in diesel prices; five countries, Morocco, Syria, Djibouti, Mauritania, and Palestine, have diesel prices at or above global average (0.87 US cents / kWh).

Figure 14: Energy Pricing Final Scores



PROGRESS HIGHLIGHTS

Bahrain and Kuwait

Both countries have recently increased residential electricity prices for expats. Also, they have increased energy costs for non-residential consumers. They have further raised their fuel prices for various types of fuel by as much as 33% for Bahrain and 80% in Kuwait. Despite these important efforts, Bahrain and Kuwait have very low energy prices. To improve their current progress, these counties would benefit from an added reduction in energy subsidies, particularly for residential electricity prices for its citizens and fuel prices.

Egypt

Recently, Egypt has stated its goal of increasing energy prices significantly according to its 5 year plan to remove energy subsidies by 2020. Since 2015, Egypt has taken several significant steps towards this goal by raising electricity prices across the board. For example, Egypt increased electricity tariffs in residential and industrial sectors. Also, Egypt has committed to cutting its fuel subsidies budget by almost 43% in 2017, reducing subsidy spending from EGP61 billion in 2015 to EGP35 billion.

Oman

Oman's energy price restructuring focuses on non-residential consumers and consumers who use more than 150 MWh. As with most GCC countries, energy prices in Oman continue to be low and expanding these initial policies across the board in the residential and non-residential sectors would increase prices and encourage the rational use of energy.

Tunisia

Marginal EE efforts were made in 2014 when Tunisia increased electricity tariffs for medium and low voltage consumers by 10%. Tunisia's 2017 budget projects an increase in electricity and gas prices, saving up to 175 million Dinar in energy subsidies, which is a decisive step in fostering EE.

Morocco

By December 2015, the government liberalized all diesel and gasoline prices in order to reduce energy subsidy spending from €2.1 billion in 2015 to € 1.4 billion in 2016, which is expected to reduce the fiscal deficit from 4.3% of the GDP in 2015 to 3.5% in 2016.

Policy Framework
Energy Planning
Regulatory Framework
Financial Incentives

3 Policy Framework

"If I am asked today what is the most important issue for global security and development - the issue with the highest potential for solutions, but also for serious problems if we do not act in the right way - it is Energy and Climate Change."

- Jose Manuel Barroso, President of the European Commission (EC), Opening Speech at World Energy Congress held in Rome, Italy in November 2007.

An effective EE policy framework is vital to developing and implementing EE strategies. Key elements of such a framework include: clear government intent and commitment for EE improvement; high-level and long-term focus with specific quantitative and time-bound EE objectives; an assigned agency for planning, designing and implementing EE measures; dedicated funding and resources to achieve stated goals; and an effective oversight of policies and measures, such as monitoring and reporting (IEA, 2009; IEA, 2010).

A policy framework gives life to EE plans and generally guides the development of the energy sector as a whole. This policy framework chapter is informed by the analyses of the supply options and demand-side measures available in the region, as well as policies and documented experiences, both successful and failed, in other developing and developed countries (IEA, 2011).

A policy framework has three major aspects: (1) Energy planning, (2) Regulatory framework, and (3) Financial incentives. These aspects are examined in more detail in Table 6, which presents their indicators and how these factors can be scored and measured.

Table 8: Policy Framework Indicators

Category	Factors	Indicator	Score/Measuring Unit
Policy Framework	Energy planning	Energy strategy with long-term EE objectives	Officially adopted; non existent
		National Energy Efficiency Action Plan	Adopted; not adopted; under development
		Quantitative, time-bound energy efficiency targets for residential, tertiary, industrial, transport and utility sectors	Adopted; not adopted; under development
	Regulatory framework	Framework legislation for EE measures	Adopted; draft prepared; non-existent
		EE regulations for buildings	Mandatory; voluntary or under preparation; non-existent
		Statutory obligation to install solar water heaters in new buildings	Adopted; under preparation; non-existent
		Minimum energy performance standards with labeling schemes for household appliances	Number of appliances covered by minimum energy performance standards
		Regulatory phase-out of inefficient lighting technology	Adopted; under development; not adopted
		EE regulations for industries	Number of regulatory policies
		Regulatory phase-out of old/inefficient vehicles	Adopted; not adopted; under development
		Policies discouraging car ownership and promoting public transport and car sharing	Number of policies adopted
	Financial incentives	EE fund	Established by law; sources of financing are clear; disbursement procedure is clear; fund is operational
		Internal tax benefits	Number of tax benefits
		Customs duty for CFLs and LED	Percentage
		Customs duty for SWHs	Percentage

3.1 Energy Planning

Energy efficiency is so crucial for a country's economic, social, and environmental progress, that it is considered a measure of development. Effective EE policy and implementation hinges on coherent and comprehensive energy planning, in order to guide a country's EE strategy. Successful plans should account for numerous factors, such as: estimations of EE potential, barriers to cost-effective EE investments, long-term indicative saving targets, existing policies, and future action plans (Price et al., 2007). Strategic and cohesive EE policies are essential, as many problems cannot simply be solved on an ad-hoc basis.

Arab states are recognizing the importance of strategic EE planning as well as addressing the complex network of energy issues within a consolidated policy framework, in order to draw up a set of national exemplary energy solutions over the long term. Such solutions for oil importing countries will provide a pathway to energy security; and for oil exporting countries, they will promote sustainable development.

3.1.1. National Energy Strategy

National energy strategies aim to ensure long-term sustainability, meet local and regional national resource security, reduce dependence on oil imports or local oil consumption, foster a continuous growth of energy supply, and increase energy efficiency. Fifteen out of the twenty Arab countries have adopted long-term strategies in the form of a master plan, program, or country development vision for the effective use of energy (Table 7). Creating a national plan enables regional states to set targets for increasing EE and can help in guiding the energy sector's development policy. Despite a differing degree of strategic development, these plans still serve as a reference for where regional states are heading in terms of their energy efficiency goals.

National EE strategies vary in their degree of comprehensiveness and ambition to reduce energy intensity. Several regional countries, for example, Tunisia, Morocco, and Jordan, see EE as a vital means to reduce energy expenditures and maintain a commitment to curbing emissions. Some of the most ambitious energy intensity reduction goals are from oil importing countries. Morocco's strategy aims to reduce energy consumption by 12% in 2020 and 15% by 2030 from the base year of 2009 and Palestine seeks to reduce energy consumption by 5% by 2020 from the base year of 2012 (Table 7). Most oil importing countries, for example, Jordan, Morocco, Egypt, Palestine, and Lebanon, aim to increase EE with multi-faceted approaches that include: financial incentives for EE lighting and solar water heaters, regulations on high-energy consuming appliances and lighting, price incentives and regulations to cut down on peak-time electricity use, and regulations to promote EE buildings. Only a few countries include transportation reforms in their national strategies, such as reduction of taxes and customs on hybrid cars and the promotion of public transport. Qatar's national strategy sees the installation of high speed railways as a means of reducing overall energy consumption, reflecting a positive step forward.

Table 9: EE Provisions in the Arab States' National Energy Strategies (2016)

Long-term Strategic Orientation with EE Objectives	
Algeria	National Program for Renewable Energy and Energy Efficiency by 2030
	Key provisions related to EE: "Thermal insulation of buildings […] Proposed measures to achieve energy efficiency in this sector include the introduction of thermal insulation of buildings, which will reduce energy consumption related to home heating and cooling by about 40%." (p. 14) "Spreading the use of low energy consumption lamps The objective of the action strategy is to gradually prohibit the marketing of incandescent lamps (conventional lamps commonly used by households) on the domestic market to reach a total ban by 2020." (p. 14) "Introducing energy performance in street lighting […] The program for energy efficiency in the municipalities consists of replacing all mercury (energy consuming) lamps by sodium (low energy) lamps." (p. 14) "Promoting Liquefied Petroleum Gas fuel There are plans to increase by 20% the market share of Liquefied Petroleum Gas Fuel (LPG / F) in the automobile fleet by 2020." (p. 15) "Introduction of key technologies for solar air conditioning By 2013, studies will be launched to acquire and harness solar cooling technologies and choose the system best suited to the Algerian context." (p. 15)
Bahrain	The Economic Vision 2030 for Bahrain
	Key provisions related to EE: "Protecting our natural environment will include: […] Implementing energy-efficiency regulations (e.g., for buildings and electrical appliances)" (Section 3.5)
Egypt	Sustainable development strategy 2030.
	Key provisions related to EE: "Economic and social outlook in the medium term: […] Social justice programs A national energy strategy for the energy and electricity sector 2035
Iraq	Electricity Master Plan 2030
	Key provisions related to EE: Master Plan of Iraq aims to develop a 20-year-long cost-effective plan for the electricity sector satisfying among others the environmental requirements. Mega projects identified in the plan include: converting existing power plants operating on crude oil to gas combined cycle power plants, lowering transmission losses by strengthening the grid, reducing losses in the distribution network by adopting better distribution planning (spatial load forecasting, network condition assessment and others), rebalancing loads across phases, improving maintenance standards and implementing other necessary techniques and solutions (Larkin, 2011).

Long-term Strategic Orientation with EE Objectives	
Jordan	Jordanian National Energy Plan draft 2007-2020
	Key provisions related to EE: "Exempt equipment – energy savers from the sales tax and customs duties and set suitable mechanisms to facilitate access to them like (solar water heaters, energy-saving lamps) on purpose to encourage citizens to rationalize and conserve energy consumption." (p. 22) "Rationalize fuel consumption in the transport sector through adoption of specialized workshops to caliber engines and wheels and other maintenance issues." (p. 22) "Reduce customs duties, sales tax and other fees on vehicles of small engines or hybrid vehicles." (p.22) "Create proper mechanisms to encourage people to use public transport modes rather than private cars especially downtown and in the traffic jam areas so that such modes are provided free of charge." (p. 23) "Set operative mechanism to apply the National Building Codes related to the thermal insulation through the following procedures: - Prepare special codes for energy-saving buildings, for gas installations in the buildings, update thermal insulation codes and general technical specifications to the buildings as of the first quarter of 2008. - Bind the engineering offices supervising the application of the energy saving-codes as of 2008. - Issue instructions to make quality assurance certificates in the residential flats as of 2008 to ensure application of procedures set forth in the national building law." (p. 23
Lebanon	Policy Paper for the Electricity Sector, June 2010
	Key provisions related to EE: "6. Demand Side Management / Energy Efficiency This policy commits to the preparation and spreading of the culture for proper electricity use; adoption of national programs focused on demand side management as the basis for: effective energy use; peak shaving; load shifting; and demand growth control in order to save a minimum of 5% of the total demand. a. Adopt the Energy Conservation law, institutionalize the Lebanese Center for Energy Conservation (LCEC) and launch a national plan for energy conservation in 2010. b. Widely spread the use of Compact Fluorescent Lamp (CFL), starting in 2010, with the aim of banning energy guzzling devices in the future. c. Increase the penetration of Solar Water Heaters (SWH), and devise innovative financing schemes in collaboration with the banking sector to achieve the slogan "A solar heater for each household". d. Encourage the use of energy saving public lighting. e. Set-up the National Energy Efficiency and Renewable Energy Account (NEEREA) as a national financing mechanism and develop the ESCO (Energy Service Company) business dealing with energy audit applications." (Ch.6) "8. Norms and Standards […] b. Develop rules and laws that promote the largest penetration of "Green Buildings (GB)" and "Energy Efficiency (EE)" in collaboration with concerned institutions. c. Comply and respect international norms and standards in the energy efficiency, environmental and public safety domains." (Ch. 8)
Morocco	National Energy Strategy Horizon 2030
	Key provisions related to EE: - 15% of energy savings by 2030 through energy efficiency programs in the building, industry and transport sectors" (Ch. I-6, p. 48) "I- Mainstreaming energy-efficient lamps: install 22,7 million energy-efficient lamps by 2012 II- Progressive reduction of the use of incandescent lamps 1- Introduction of mandatory minimum energy performance standard for lamps 2- Reducing customs duties on import of energy-efficient lamps (Ch. I-6, p. 47)" (Ch. I-6, p. 47) "Implementation of price incentives to reduce or halt peak consumption, affecting all potential consumers: Pricing: - 20%/20% tariff Dual pricing schedule High-peak pricing" (Ch. I-6, p. 49) "Implementation of measures to halt consumption during peak hours and during high load periods agreed upon between the government and ONEE Signing of contract program between government and ONEE to set a clear and quantified objectives for the reduction of electricity consumption by 2012" (Ch. I-6, p. 50)

Long-term Strategic Orientation with EE Objectives	
Palestine	National Energy Strategy 2012-2020
	Key provisions related to EE: "The aim of the plan is to achieve the indicative target of 5% less electricity consumption by 2020 equivalent to approximately 384 GWh per year. In order to achieve this target, a number of measures and procedures should be implemented and scheduled according to specific phases. Each phase lasts for 3 years. Evaluation indicators to measure the implementation progress should be identified in order to perform a comprehensive review at the end of each phase before proceeding to the next phase." (NEEAP Preface)
Sudan	Under Development
Tunisia	Tunisian Solar Plan 2010, last updated in 2012; The national Energy Strategy "Energy 2030" adopted in 2004 is under revision within a national debate and consultation launched in 2013
	Key provisions related to EE: An electrical efficiency scenario exists in which Tunisia considers that energy efficiency measures for electricity savings, launched between 2008 and 2012, will continue to produce energy savings in electricity until 2020. Beyond 2020 it is considered that the intensity will continue to decrease with the same average annual rate for the period 2013-2020, i.e. 0.6% per year. According to this electrical efficiency trend scenario, the final electricity demand would reach 20.8 TWh in 2020 and 34.9 TWh in 2030. Another more proactive electrical efficiency scenario exists (retained by the electricity mix strategy) that, in addition to energy efficiency actions launched between 2008 and 2012, also incorporates those energy efficiency measures launched between 2013 and 2020. Beyond 2020 this scenario considers that the energy intensity will grow by -1.5% between 2020 and 2025 and by -1% between 2025 and 2030. These negative energy intensity growths will reflect the constraints in accessing further energy efficiency sources. The average annual rate of energy intensity decrease between 2013 and 2030 will be 2.0% in this case. To achieve this goal of reducing the energy intensity and increase electricity efficiency, Tunisia will implement an ambitious strategy in terms of energy efficiency, mobilizing incentives, regulatory and institutional incentives. (Tunisian Solar Plan, p. 9-10)
Yemen	National Strategy for Renewable Energy and Energy Efficiency, 2009
	Key provisions related to EE: "1.3 Proposed policy objectives to promote renewable power generation and energy efficiency • […] eliminate peak and energy shortages faced by the electricity sector through the promotion of renewable energies as well as through improved energy efficiency and conservation among main consumer classes, • alleviate the impact on the poor of future rising fuel and electricity prices by promoting energy efficiency and conservation initiatives," (p. 3) "Strategic Measures **Energy Efficiency targets:** […] Baseline scenario – 15% increase of energy efficiency in the power sector until 2025." (p.6) "Specification of energy efficiency standards, labels protocols, codes of practice and other criteria for energy efficiency and conservation." "Provision of fiscal incentives and disincentives through tariffs and taxation to promote energy efficiency and conservation." "Establishment of a Renewable Energy and Energy Efficiency Fund to be managed under the MEE to provide financing for smart subsidies, demonstration projects and barrier removal activities" (p. 8) "Phased institutional approach at the MEE: • Immediate creation of a General Department for REN and EE in the MEE with units for […] Energy Efficiency and Demand Side Management • Creation of a separate sector for REN and EE in the MEE headed by a Deputy Minister within 3 years • Creation of a separate Authority for REN and EE under the MEE within 5 years" (p. 8) "Creation of a national training center for REN/EE within PEC's Dahban Training center to carry out capacity building programs in the field of REN/EE to test and license REN equipment, and to certify energy efficient products." (p.9)
Saudi Arabia	National Energy Efficiency Program (NEEP) 2005-2030
	Key provisions related to EE: "Objectives: • 30% reduction in electricity intensity between 2005 and 2030 • 50% reduction in peak demand growth by 2015 compared with the 2000-2005 increase" In 2008, eight priority objectives were defined in the NEEP including energy audit services and industry support, efficient use of oil and gas, energy efficiency labels and standards for appliances, constructions codes, training and public awareness. "The NEEP currently focuses on four outcomes: regulation (design of the first Energy Conservation Law and national and regional regulations), information (new national database on energy supply and demand), capacity development of energy efficiency managers and public awareness on energy conservation" (Saudi Arabia EE Report, 2013).

Long-term Strategic Orientation with EE Objectives	
Kuwait	Kuwait Vision 2035
Oman	Oman Energy Master Plan 2040
	Key provisions related to EE: • Enforce building codes and standards for sustainable homes to promote water savings and energy efficiency, such as the development of green homes. • Promote a nationwide awareness campaign and change in behavior in order to boost the level of energy efficiency in homes, workplaces, and modes of transport throughout Oman.
Qatar	Qatar National Development Strategy 2011-2016 towards Qatar National Vision 2030 by the Qatar General Secretariat for Development Planning.
	Key provisions related to EE: "Target: Enact a comprehensive National Water Act establishing an integrated system of quality requirements, discharge controls and incentives for conservation—in place of today's fragmented system of laws and regulations." (p.220) "[…] Lower network water losses to 10% by 2016, from the present 35%." (p.220) "Target: Halve gas flaring to 0.0115 billion cubic meters per million tons of energy produced from the 2008 level of 0.0230 billion cubic meters per million tons of energy produced." (p. 224) "The Qatar Sustainability Assessment System for Green Buildings will establish green building standards to which all government buildings will have to conform by 2016." (p. 222) "To lessen automobile dependence, the government is planning a high-speed rail line connecting Doha, Bahrain and Saudi Arabia, plus an underground monorail." (p.222)
UAE	Abu Dhabi Economic Vision 2030 Dubai Integrated Energy Strategy 2030
	Key provisions related to EE: Abu-Dhabi "Objectives: • To ensure new development respects scaled to the natural environment; • To create plans that respond to the desert climate, respecting water assets and making use of sustainable energy and waste techniques and technologies where appropriate." (p. 72) "Abu Dhabi's future lies in the ability to prudently use its existing wealth to actively explore renewable energy production, reduce the consumption of non-renewable resources and educate future generations. Resource efficiency is vital, and the implementation of Estidama will support Abu Dhabi's move to become a truly sustainable Emirate." (p. 80) Dubai Dubai Integrated Energy Strategy 2030 includes eight demand side management programs in three areas: power, water, and transportation fuel. These programs include: updating green building regulations, building retrofits, district cooling for new developments and retrofits, standards and labels for appliances and equipment, efficient street lighting, change of tariff rates, and implementing demand response programs.

3.1.2. Targets and Action Plans

The Arab region is highly dependent on fossil fuels to meet its energy demands, which makes the mass deployment of EE systems vital to offset the region's environmental impacts and continuous stress on its natural resources. A regional EE plan for both energy supply and use will help mitigate the domestic and global environmental impact of energy consumption by reducing both atmospheric particulate matter and GHG emissions (Zafar, 2017).

Regional governments are already taking bold steps to adopt new national plans that put forth EE standards to reduce domestic energy consumption. The Arab Ministerial Council for Electricity, the head of the energy department of the Arab League, published the Arab Energy Efficiency Guidelines in 2010. These guidelines, based on the European Directive 2006/32/EC on energy end-use efficiency and energy services, require Arab states to develop National Energy Efficiency Action Plans (NEEAPs). NEEAPs put forth a comprehensive strategic national planning framework, ideally covering a period of three years, to help ensure Arab countries meet the long term goal of significant energy savings. Such plans are intended to be applied to energy suppliers, distributors, and energy end-users. States are also required to assign the responsibility for oversight, coordination, and reporting to one or more, new or existing authorities or agencies (Arab Ministerial Council for Electricity, 2010).

The individual NEEAPs, however, are inconsistent in terms of policy, scope, and implementing body(ies). For example, some NEEAPs are not nationally applied, while other NEEAPs do not adhere to the template developed by the Arab Energy Efficiency Guidelines. Yet some countries that have recently developed their first NEEAP, such as Bahrain (with technical support of UNDP), have adhered to the Arab Energy Efficiency Guidelines template. Most EE plans are implemented by ministries responsible for energy or electricity, while other plans are implemented by various ministries and bodies responsible for EE.

Table 10: Status of EE Action Plans (2016)

Country	Action Plan	Status
Algeria	NEEAP 2011-2013	Adopted in 2011, Final draft prepared
Bahrain	NEEAP	Adopted in 2017
Djibouti	N/A	N/A
Egypt	NEEAP 2018-2020	Under Preparation
Iraq	NEEAP 2013-2016	Adopted in 2013, under implementation
Kuwait	KISR Energy Efficiency Technology Program	Adopted
Lebanon	NEEAP 2016-2020	Adopted in 2016, under implementation
Jordan	NEEAP 2018-2020	Under Preparation
Libya	NEEAP 2014-2016	Under final stages of approval
Mauritania	NEEAP	Under development
Morocco	National Energy Efficiency Strategy 2030	Adopted in 2009
Oman	NEEAP	Specific EE measures, under Implementation
Palestine	NEEAP 2015-2017	Adopted in 2015
Qatar	Tarsheed" the National Conservation and Energy" Efficiency Program 2012-2017	Adopted in 2013, under implementation
Saudi Arabia	National Energy Efficiency Program	Adopted
Sudan	NEEAP 2013-2016	Adopted in 2013, under implementation
Syria	NEEAP	Final draft prepared in 2011
Tunisia	Triennal Program 2005-2007 Quadriennal Program 2008-2011 New Energy Program 2013-2020	Implementation completed Implementation completed Adopted in 2014, under implementation

Country	Action Plan	Status
UAE	Abu Dhabi Comprehensive Cooling Plan Dubai Integrated Energy Strategy 2030	Adopted Adopted
Yemen	NEEAP	Under preparation

Bahrain's new National Energy Efficiency Action Plan

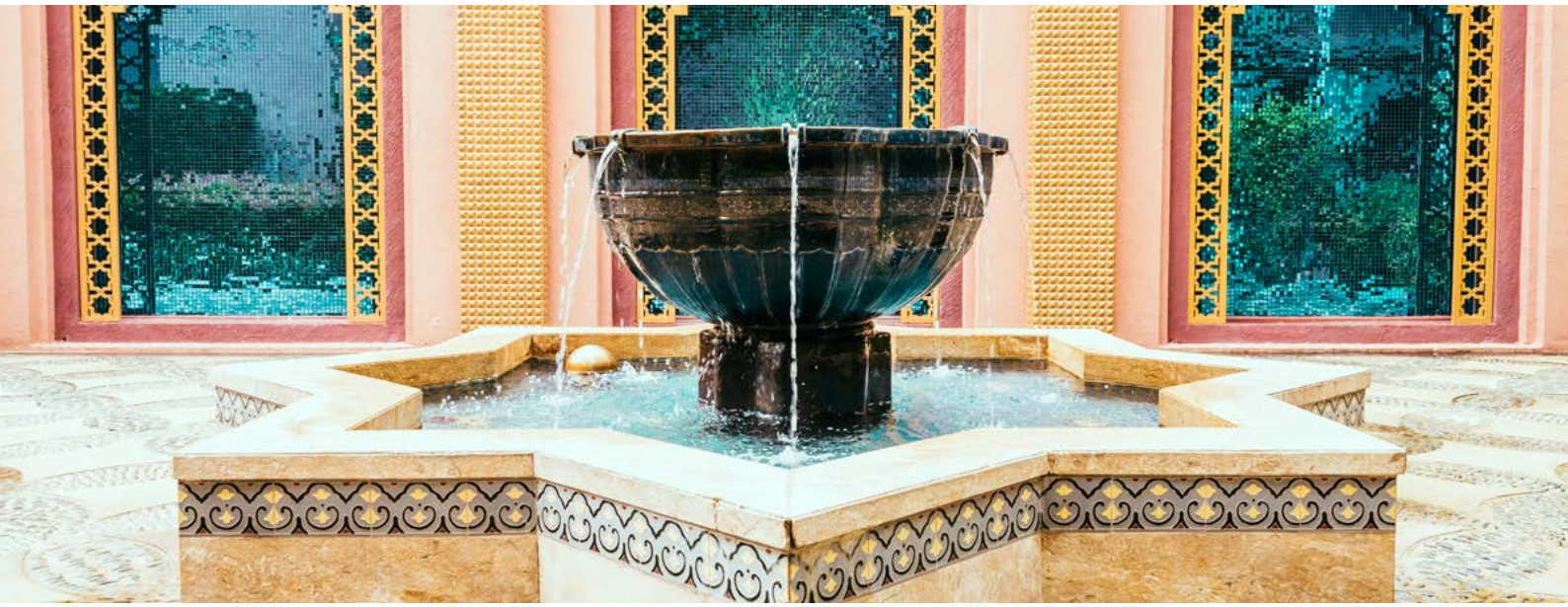
The Kingdom of Bahrain and the United Nations Development Programme (UNDP) have partnered in recent years to establish a Sustainable Energy Programme aimed at developing a sustainable energy policy and to promote renewable energy and energy efficiency measures in the country. This includes approximately $6 million of Government contributions to the programme for technical assistance activities. One initial outcome of the programme has been establishment of and capacity development for a new Sustainable Energy Unit (SEU) in Government, a new national designated entity mandated to lead and promote energy efficiency practices, transfer and diffuse renewable energy technologies and draft related policies & regulatory frameworks in close coordination with stakeholders and partners in the Kingdom of Bahrain. It works towards bridging the legal, institutional, and capacity gaps in order for the Bahrain energy sector to meet future challenges.

Building on initial designs for the National Energy Efficiency Action Plan (NEEAP) developed with the support of RCREEE, one initial outcome of the SEU has been the completion of the NEEAP and its adoption in 2017. NEEAP addresses the various challenges facing Bahrain as it seeks a more sustainable energy future, including the setting of 2030 targets for energy intensity reductions across key sectors. Through the lead role of Bahrain's Electricity and Water Authority (EWA), the NEEAP was presented to the Supreme Council for Energy and related government authorities for endorsement and approved by the Cabinet. The Ministry of Electricity and Water Affairs also set up the formation of the National Committee to supervise the implementation of the NEEAP. Through the partnership between UNDP and EWA, capacity development support will be provided through the ongoing Sustainable Energy Programme to help partners in public and private sectors achieve the new 2030 targets. This helps achieve a more sustainable energy trajectory locally and alignment with global goals under the new Paris Agreement on Climate Change and Sustainable Development Goal 7 on sustainable energy.

Table 11: Energy Efficiency Targets

Country	Action Plan	EE Indicative Targets				Implementing/Mandated Agency
		Sector	%	Equivalent	Target Year	
Egypt	NEEAP 2012-2015	Macro	4.96	5,565 GWh	2015	The Energy Efficiency Unit of the Ministry of Electricity and Renewable Energy
		Residential and Tertiary	4.96	5,565 GWh	2015	
Iraq	NEEAP 2013-2016	Public	5	-	2016	Ministry for Electricity Planning and Studies Department
Jordan	NEEAP 2018 - 2020	Macro	17.5%	1975 GWh	2020	National Center for Research and Development, Energy Research Program (NERC)
		Residential	22.4%	998 GWh		
		Industrial	12.7%	383 GWh		
		Commercial & services	20.0%	376 GWh		
		Water Pumping	9.8%	163 GWh		
		Street Lighting	19.1%	55 GWh		
Kuwait	KISR Energy Efficiency Technology Program	Improve EE power stations	5			Kuwait Institution for Scientific Research (KISR)
		Reduce energy consumption in existing building	10			
		Reduce energy consumption in new buildings	30			
Lebanon	NEEAP 2016-2020	Reduce electricity demand growth rate from 7% to 5.81%	5.81%	302.96 GWh/ year	2020	The Lebanese Center for Energy Conservation (LCEC)
		Power		686,136,822 kWh		
		Horizontal and End user		49,200,000 kWh		
		Building		148,922,440 kWh		
		Industry & Agriculture		610,251,000 kWh		
		Public		19,731,620 kWh		
Morocco	National Energy Strategy Horizon 2030	Industry	Reduce energy intensity by 2.5%/year		2030	Moroccan Agency for Energy Efficiency (AMEE)
		Transport	Reduce energy consumption by 35%			
		Buildings	Reduce energy consumption by 20%			
		Agriculture	Reduce energy intensity by 0.2%/year			
		National	Reduce Final energy consumption by 25% and primary energy consumption by 15%			

Country	Action Plan	EE Indicative Targets				Implementing/Mandated Agency
		Sector	%	Equivalent	Target Year	
Palestine	NEEAP 2015 - 2017	Macro		137 GWh	2017	Palestinian Energy Authority (PEA)
		Residential and Tertiary		130 GWh		Palestinian Energy
		Industrial		6 GWh		Environment Research Center (PEC)
		Water and pumping		1 GWh		
Qatar	"Tarsheed" the National Program for Conservation and Energy Efficiency 2012 - 2016	Electricity	Reduce electricity consumption per capita by 20 % from 2011 levels		2017	Qatar General Electricity and Water Corporation "KAHRAMAA"
		Water	Reduce water consumption per capita by 35 % from 2011 levels			
Sudan	NEEAP 2013-2016	Macro	4.6	280.8 GWh	2016	Electricity Regulatory Authority
		Residential	1.4	87.6 GWh	2016	
		Governmental	3.1	193 GWh	2016	
Tunisia	New Energy Program 2013-2020	Industry	26	4.4 Mtoe	2020	Agence Nationale pour la Maîtrise de l'Energie (ANME)
		Building	49	8 Mtoe	2020	
		Transport	25	4.1Mtoe	2020	
UAE-Abu Dhabi	Abu Dhabi Comprehensive Cooling Plan	Reduce Electricity consumption in end-use sectors	15% of 2010 demand	4,500 GWh/ year	2020	Abu Dhabi Cooling Taskforce
UAE - Dubai	Dubai Integrated Energy Strategy 2030	Reduce energy demand by 30% by 2030				The Dubai Supreme Council of Energy



The diversity of EE targets in Arab states can be seen in Table 11, which presents EE targets based on each country's action plan. Most countries have defined goals to reduce energy consumption in buildings (residential, public, and commercial), as well as in industrial and agricultural sectors. The most common measures found in regional action plans include: promoting EE lighting, installing solar water heaters, and conducting energy audits in industrial facilities. Other plans have established steps for developing standards and labeling for household appliances, designing energy efficiency building regulations, and improving energy efficiency in water pumping. Tunisia and Morocco are the only regional countries with long term EE goals in the transportation sector.

The Arab Energy Efficiency Guidelines state that countries should state their 2020 EE targets in terms of both a percentage of baseline consumption and as GWh to be saved. The Arab Energy Efficiency Guidelines further stipulate that the baseline energy consumption should be calculated based on the annual average of final energy consumed in the past five years before the adoption of the Arab EE Guideline at end of 2010. This number is a fixed amount and is independent from GDP growth or any future increases in energy consumption. See Appendix 3: The methodology for calculating the national indicative target for energy savings, Arab Guidelines, 25 November 2010.

The details of EE targets for regional countries NEEAPs or other equivalent EE plans are presented in Table 11. Several regional countries have established stated goals to reduce overall electricity consumption in their EE action plans, including: Egypt, Morocco, Sudan, Palestine, Kuwait, Jordan, and Tunisia. Most EE action plans focus on reducing energy consumption and losses in buildings, both residential and non-residential. Few countries have plans to increase EE in the industrial, agricultural, and public sector. Qatar for example, aims to reduce energy consumption associated with the water sector by 35% from its 2011 levels in an effort to counteract the large amounts of energy utilized in its water desalination plants. The transport sector is often excluded from regional EE action plans, with the exception of Morocco and Tunisia. The most common measures to reduce energy consumption in Arab states' action plans are through implementing EE lighting, installing solar water heaters, and conducting energy audits in industrial facilities. Additional measures focus on developing standards and labeling for household appliances, creating energy efficiency building regulations, and promoting energy efficient water pumps.

Lebanese NEEAP

The Second National Energy Efficiency Action Plan for Lebanon, "NEEAP 2016-2020", continues to build on the initiatives proposed in the first NEEAP 2011-2015. The implementation of the NEEAP 2016-2020 requires an investment of 600-950 Million US$ over a period of 5 years, creating a huge positive market momentum (LCEC, 2016).

The NEEAP 2016-2020 is divided into two main sections: The power sector EE measures and the end-use EE measures. The power sector measures tackle energy efficiency in electricity generation, transmission, and distribution. The end-use section comprises of five chapters:

1. Horizontal End-Use measures

2. End-Use measures in the Building Sector

3. End-Use measures in the Industry and Agriculture

4. Measures in Mobility and Transport

5. End-use measures in the Public Sector

Moreover, the NEEAP 2016-2020 includes different types of measures regarding policies, regulations, action plans, and implementation. Each measure is written in a tabulated form, followed by a section explaining the savings calculation methodology. The tabulated form includes: the measure's aim, its description, its estimated savings, input, output, and outcome indicators, funds for completion, and next steps. By implementing the second NEEAP's 26 initiatives, the actual electric power growth rate of 7% could be reduced by around 17% to be 5.8% by 2020. The "NEEAP 2016 -2020" estimates an energy reduction of 302.9 GWh/year leading to a new demand growth rate in the electricity power sector of 5.81% down from 7%.

The second Lebanese NEEAP is distinguished from its previous version (NEEAP 2011-2015), as it is solely dedicated to the country's energy efficiency initiatives and targets; whereas the 2011-2015 NEEAP encompassed both energy efficiency and renewable energy initiatives. Furthermore, the second phase of the NEEAP includes additional energy efficiency initiatives covering various new sectors, such as five additional energy efficiency initiatives in the power sector specifically including power generation, distribution, and metering. The second phase also includes a section on energy efficiency for industries and agriculture as well as energy efficiency measures for the transport sector.

3.2. Regulatory Framework

3.2.1. Energy Efficiency Law

EE regulatory frameworks set the foundation for states to implement effective EE measures by establishing the statutory basis for states to adopt and enforce EE policies. Such frameworks typically involve different levels of legislation, bringing together the participation of a wide network of stakeholders. Given their importance, regulatory frameworks demonstrate a strong political commitment to EE.

Eleven countries in the region have EE laws, as shown in Table 12. Most of the EE frameworks establish regulations on labels and standards for appliances, set forth EE building codes, require mandatory EE audits, and implement restrictions on the use and sale of high-energy consumption products, such as incandescent lightbulbs. Other regional frameworks establish EE agencies, and in the case of Morocco, extend the authority of such agencies. Also, EE frameworks have been used to create EE funds, necessary for implementing EE policies.

While the establishment of EE frameworks is a significant step, not all regional countries have passed and implemented their policies through the promulgation of bylaws. Some countries, like Tunisia, have implemented many bylaws that have helped the country enforce its EE policies and reduce energy consumption. Without the promulgation of bylaws, EE frameworks cannot effectively be enforced.

Table 12: Status of EE Laws and Implementing Bylaws (2016)

Country	Framework Law for EE Measures	Implementing Bylaws
Algeria	Law No 1999-09 (1999) on energy conservation	• Decree No. 2000-90 (2000) on energy isolation of new buildings • Decree No. 04-149 (2004) on fixing the implementation process of the law No 1999-09 • Decree No. 05-16 (2005) on specific energy efficiency rules for appliances running on electricity, gas, and petroleum products • Decree No. 05-495 (2005) on energy audits for large energy consumers • Bylaw: 21/2/2009 on labels and standards for domestic lamps, refrigerators, and AC • Bylaw: 29/11/2008 on general provisions related to the organizational arrangements and the energy efficiency control of electric domestic appliances and subject to specific rules on energy efficiency • Bylaw: 22/12/2016 on identifying income and expenditure list in account number 131-302 title " national fund for energy control and renewable and combined"
Bahrain	Law No 13 -1977 on Organizing buildings	• Bylaw No (2) – 1998 amendment of executive regulation for the law No 13 -1977 • Decree No 8 /1999 on installation of thermal insulation in buildings for both the commercial and government sectors • Decree No 63/ 2012 on installation of thermal insulation in Residential sector
Djibouti	None	None
Egypt	Electricity law No. 87/2015. Articles (45,46,47,48,49,50 and 51)	• Decision No 230/2016 executive regulations of electricity law 87/2015
Jordan	Law No. 13 (2012) on renewable energy and energy efficiency Law No. 33 (2014) on amendment of Law No. 13 (2012)	• Bylaw No 73 (2012) on regulating procedures and means of conserving energy and improving its efficiency, issued by virtue of Article (18) of the Renewable Energy and Energy Efficiency Law No 13 (2012) • JREEEF By-Law 49 of 2015 • RE/EE Tax Exception By-Law 13 of 2015
Kuwait	None	-
Lebanon	Draft law on energy conservation	-
Libya	None	-
Mauritania	None	None
Morocco	Law No. 47-09 (2009) on energy efficiency Law No. 16-09 (2009) on extending the authorities of the National agency for RE to include EE	• Approving the decree No. 2-13-874 (2014) on EE building codes • Decree No. 17-10-1 (2010) on approving the extension of the national agency for RE to include EE
Oman	None	None
Palestine	The Renewable Energy and Energy Efficiency Law in Palestine regulates the mechanism for investment in renewable energy and energy efficiency	-
Qatar	Law No. 26 (2008) on energy efficiency in electricity and water consumption	• Ministerial decision No. 42 (2011) on establishing a unit for energy efficiency (Article 4)
Saudi Arabia	None	Decree No. 6927 on the installation of thermal insulation on all new residential, commercial or other buildings
Sudan	None	-
Syria	Law No. 3 (2009) on energy conservation Law No. 17/2013 on Establishment of the Domestic Solar Heating Fund at the Ministry of Electricity	-

Country	Framework Law for EE Measures	Implementing Bylaws
Tunisia	Law No. 2004-72 (2004) on energy efficiency further amended by Law No. 7 (2009) Law No. 82/2005 on power control Law No. 106/2005 on establishment of the National Fund for Energy Control	• Order No. 148 / 2000 dated 24/1/2000 relating to the regularization of the technical inspection of vehicles and procedures, the conditions of delivery of technical inspection certificates, and the data they must include • Order No. 1497 of 2005 dated 11/5/2005 concerning the regularization of the technical inspection of vehicles and the amendment to Order No. 148 of 2000 • Decree No 2004-2144 (2004) establishing obligations of conducting mandatory periodic energy audits • Order No. 2269 / 2009 dated 31/7/2009 concerning the revision of Order No. 2144 - 2004 concerning the establishing obligations of conducting mandatory periodic energy audits, • Decree No 2004-2145 (2004) on EE labels and standards for appliances and equipment • The joint decision of the Minister of Industry, Energy and Small and Medium Enterprises and the Minister of Commerce and Handicrafts dated 24/10/2005 concerning the minimum energy efficiency for refrigerators, freezers and dual machines • The joint decision of the Minister of Industry, Energy and Small and Medium Enterprises and Minister of Transport dated 10/8/2007 relating to the approval of the booklet of conditions relating to the regulation of the practice of diagnosing motor vehicles whose total authorized weight does not exceed 3500 kg and does not exceed the more than nine seats (including the driver's seat) in the private sector • Order No. 4193 /2007 dated 27/12/2007 related to the control of the percentage of fees on lamps • Order No. 3210/2008 dated 6/10/2008 regarding the control of the percentage of fees on lamps and the amendment to order number 4193 for the year 2007 • Mandatory Decree of 23 July 2008 dealing with minimum technical specifications for energy saving in building projects or refurbishment of existing administrative buildings • The joint decision of the Minister of Industry, Energy and Small and Medium Enterprises and the Minister of Commerce and Handicrafts dated 27/10/2008 in respect of the minimum efficiency in energy consumption for refrigerators, freezers, double machinery. • The joint decision of the Minister of Industry, Energy and Small and Medium Enterprises and the Minister of Commerce and Handicrafts dated 21/4/2009 in respect to labels for individual air conditioners with cooling capacity of less than 12 kW. • The joint decision of the Minister of Equipment, Housing and Urban Planning and the Minister of Industry, Energy and Small and Medium Enterprises on 1/6/2009 concerning the adjustment with minimum technical specifications aimed at the energy efficiency of construction projects and expansion of buildings intended for housing • A joint decision of the Minister of Industry, Energy and Small and Medium Enterprises and the Minister of Commerce and Handicrafts dated 30/6/2009 concerning the minimum energy efficiency of individual air conditioners with cooling capacity below 12 kWDecision dated 09/02/2006 on technical characteristics of the energy economy at the stage of installation of public lighting networks. • Order No. 3377 / 2009 dated 2/11/2009 on the combined generation and modified order 3232 for the year 2002 • The decision of the Minister of Industry, Energy and Small and Medium Enterprises, dated 11/6/2007 approving the booklet of special specifications in the energy audit on the plan in the residential and services sectors. • Joint decision of the Minister of Industry and Technology and the Minister of Commerce dated 12/08/2011 in respect to the minimum efficiency in energy consumption for individual air-conditioners with cooling capacity of less than 12 kW. • Order number 2234/2005 fixing the rates and amounts of grants for operations related with energy conservation, conditions and disbursement procedures, as revised by Decree No 362 (2009). • Order No. 1521/2010, amendment of Decree No. 744 of 1995, concerning the development of a list of raw materials and semi-finished materials used in renewable energy and energy efficiency • Joint order of Ministry of Industry and Technology and the Ministry of Commerce and Handicraft of 18 August 2010 prohibits the sale of incandescent light bulbs with power superior or equal to 100 watt and voltage superior or equal to 100 volt is banned effective from 1 January 2011
UAE	Under preparation by the Ministry of Energy (McAuley, 2014)	
Yemen	None	Cabinet decision No 302/2010 on governmental actions required for energy efficiency and rationalization of consumption

3.2.2. EE Building Regulations

The building sector in the Arab region is rapidly expanding, with an expected annual growth of 6.9% from 2016 – 2020. With a rising population in the region, a projected 24 million new housing units will be built by 2030 (Visser and Yeretzian, 2013). Further, an estimated $4.3 trillion will be spent on construction in the region by 2020 (Global Construction Perspectives and Oxford Economics, 2011). The building sector is a major consumer of energy in the region, making the implementation of EE practices in this sector particularly impactful in reducing energy consumption.

The residential sector accounts for significant energy consumption in the region and makes up around 42% of the total final energy consumption in Arab states. The energy requirements in the residential sector are numerous and include: heating, hot water, cooking, cleaning, washing, drying, lighting, cooling, and entertainment. The total energy demand for the residential sector could be reduced through energy efficiency measures, regulations, and building codes. The rising population in the region and expansion of the building industry makes the reduction of energy consumption in the building and residential sectors vital.

13 regional countries have put forth EE building regulations, of which 11 countries' policies are mandatory, as is shown in Table 13. Three regional countries have building regulations in development, while two countries do not have any building regulations. The most common form of building regulation in the region is thermal insulation requirements for new constructions. While thermal installation regulation is a step in the right direction, such policies alone are not sufficient in making a building substantially more energy efficient.

To make significant reductions in energy consumption, countries need to implement energy policies based on long-term, comprehensive, and systematic changes in building regulation. Few regional countries have such plans that include mandatory EE audits for buildings and required compliance with comprehensive EE building codes. Even if such plans exist, there is an overall trend of not enforcing such policies.

Egypt's New Electricity Law 87 for the Year 2015

On July 08, 2015, the president of the Arab Republic of Egypt issued the Electricity Law No. 87 of 2015. The new law was enacted in light of recent developments in the regulation field of public utilities and the state's increasing interest in regulating, controlling, and monitoring the activity of public facilities instead of managing them in a direct way. It aims at raising the performance efficiency and service level of the companies operating in the field of production, transmission, distribution, and sale of electricity. It includes many energy efficiency related articles. Mainly chapter four tackles the 'Improvement of Electric Power Use Efficiency" as follows :

Article 45: Network operator or electricity distribution licensees shall purchase or pay for the surplus electric power deriving from the common electricity generation units and other recoverable energy electricity production units with capacity of less than 50 MW, provided that such transactions shall be conducted under conditions and at prices set by the Agency

Article 46: Network operator and electricity distribution licensee shall have the common electricity generation units and the other recoverable energy electricity production units connected with their networks, provided that they shall bear the costs required for their networks expansion while the producer shall bear the networks connection costs

Article: 47: Network operator and electricity distribution licensee may enter into loads-reducing or loads-carrying forward contracts with the Consumers and Authorized Distributors, provided that no favoritism shall be exercised in the course of their transactions. The Executive Regulations shall set the controls to be considered in the course of concluding these contracts

Article 48: Subscribers whose contractual capacity exceeds 500 KW shall appoint officials to be assigned to improve the power usage efficiency and keep a power register in the manner described in the Executive Regulations

Article 49: Network operator or electricity distribution licensee shall apply a proposed annual plan to be approved by the Agency for the purpose of implementing projects and programs serving the consumers in the following fields:

- Management of Electric power demand.
- Improvement of electric power usage efficiency.
- Promotion for renewable energy uses.
- Raising awareness of power usage efficiency. In the course of issuance of a license validity certificate, the Agency shall verify the scope of applying the annual plan

Articles 50: The entity assigned by the cabinet to improve electricity usage efficiency shall, in cooperation with the other competent authorities, develop policies aiming to:

- Expand the scope of developing power efficiency specifications and cards for the electricity-consumptive devices and equipment
- Replace the low-efficiency devices and equipment with others, as set forth in the Executive Regulations.
- Improve the electric power usage efficiency in the industrial and commercial systems.

Article: 51: Producers and importers of the electricity consumptive devices and equipment shall place power efficiency cards on the electric devices, in accordance with the Ministerial Decrees issued in this respect and the provisions of the Executive Regulations.

Later, in May 2016, the Executive Regulation 230/2016 (the "Executive Regulation") of the Electricity Law 87/2015 was released in the Egyptian Gazette. The regulation was issued by the Minister of Electricity & Renewable Energy. It explains more details related to the principles, procedures, and documentations stated in the law.

The main areas where the Executive Regulation provides detailed rules include:

- Electric utility organization
- Governing rules determining the tariffs, prices, and fees paid by various electricity actors for various types of activities and services generation and distribution of electricity licensing regime.
- The committee for dispute settlement
- Improvement of electric power usage efficiency and energy efficiency officer tasks
- Distributors overlap

Table 13: Status and Type of EE Regulations for Buildings

Country	Energy Efficiency Regulation	Type
Saudi Arabia	Saudi Energy Efficiency Building Code (2007). The codes were introduced on a voluntary basis in 2009 and became mandatory in 2010. The code covers all of a building's energy systems including: the envelope, mechanical, electrical, lighting, and domestic hot water systems. It has both, prescriptive and performance compliance options.	
	Since 2014, the Saudi government has required the mandatory installation of thermal insulation in walls and roofs for all new buildings as a condition to obtain a connection to the electricity grid.	
Bahrain	Thermal insulation regulation for all buildings (2013)	
	Code of practice for thermal insulation in buildings issued by Ministry of Electricity & Water (2002)	
	Thermal insulation for commercial buildings (1999)	
Kuwait	Mandatory Energy Conservation Code for Practice for Buildings No R-6, (2014)	
Qatar	Qatar Construction Specifications QCS (2010) green buildings have been further elaborated in QCS (2014). It is mandatory for all public and private sector projects to obtain Global Sustainability Assessment System (GSAS) certification.	
Egypt	Building Energy Efficiency Codes (BEECs) were introduced in Egypt between 2005 and 2009. They impose mandatory energy performance requirements for residential, commercial, and public buildings in three different code documents. However, these codes are not enforced.	
	EE code for commercial buildings (2006)	
	EE code for residential buildings (2003)	
Algeria	EE Building Code (2013)	
	Thermal regulations for new buildings (2005)	
	Thermal regulations for new buildings (2000): This article makes it mandatory for building owners to apply the thermal regulation in all buildings (except the individual building units, a five year extension has been given until the article applies for them as well)	
	Thermal regulations for new buildings (1997)	
	Act 99-09 dated 28 July 1997is concerned with energy control in buildings and energy efficiency of new buildings	
Iraq	EE specifications for buildings (2012) In 1987 the Iraqi building code was suggested to be used optionally for two years. The government did not adopt the code legally. For that reason, Iraqi designers and engineers did not use the code, and depended on ACI and British codes in their works for the last forty years. In 2013, the Ministry of Construction and Housing adopted the Arabic codes. These codes are issued by the Council of Arab Ministers of Housing; during this year (2014), the Iraqi ministries started to adopt these codes in their buildings works.	
UAE	The Green Building Regulations and Specifications (2012) for public buildings in Dubai and later in 2014 for the private commercial buildings.	
	Estidama has a 1 Pearl and 2 Pearls Rating System (PRS) for Buildings (2010). All new development projects in Abu Dhabi must achieve at least the 1 Pearl rating, while government office projects must achieve, at minimum, a 2 Pearl certification.	
	Regulations on the technical specifications for thermal insulation systems (2003)	
	Energy efficiency lighting standard (2014), will be mandatory	
Syria	Building thermal insulation code (2006), effective since 2009	
	Energy efficiency code in buildings (2010) (GEF Project UNDP), project status: Cancelled, 2013	
Tunisia	EE specifications for residential buildings (2009)	
	EE specifications for office buildings (2008) for offices or similar premises that are not occupied at night and for public and private buildings whose floor area ≥500 m2	
	Mandatory measures for the thermal performance of new buildings (2004)	
	Minimum EE specifications for residential, administrative buildings, hospitals, and hotels were set in 2008-09	

Country	Energy Efficiency Regulation	Type
Lebanon	EE building code	
Jordan	Green building manual (2015)	
	Solar energy code (2012)	
	Energy efficiency buildings code (2008)	
	Thermal insulation code (1998)	
Morocco	Thermal regulation for construction in Morocco (mandatory from November, 2015)	
	Energy efficiency codes in residential buildings and energy efficiency improvement in Commercial and Hospital Buildings (supposed to be implemented in 2014)	
	Act 47-09 concerns energy efficiency in buildings (residential and commercial), transport and industry. It introduces energy performance ratings for buildings, equipment and appliances, compulsory energy audits for facilities exceeding a certain consumption threshold in the industrial and the service sector, prior energy impact assessments for urban development and construction programs when anticipated consumption exceeds a certain threshold, and technical energy efficiency measures.	
Palestine	Green buildings guidelines (2013)	
	EE building code (2004)	
Oman	EE&C building regulations (2013). it's part of Oman's master plan for energy efficiency and conservation (EE&C). The implementation schedule of the EE&C regulation aims to start pilot implementation from 2016 and full scale implementation from 2018.	

legend: Under Preparation Voluntary Mandatory

Bahrain – A Case Study in Building Thermal Insulation

The Kingdom of Bahrain's Electricity and Water Authority has implemented a series of comprehensive regulations that aim to install thermal insulation in many of the country's buildings. Bahrain has very hot summers and air conditioning is widely used; it accounts for 47% to 57% of all electricity demand during the summer months. To make air conditioning more energy efficient, Bahrain has turned to thermal insulation. Using thermal insulating materials to construct the walls and roofs, as well as provide insulation for windows, can drastically decrease the rate of heat flow in and out of buildings. Thermal insulation ideally reduces the flow of heat from the outside to the inside of a building in the summer and keeps heat inside buildings in the winter.

There are numerous economic and environmental benefits of implementing thermal insulation policies for both consumers and countries in the Arab region. Thermal insulation maintains room temperature while decreasing electricity demand, which contributes to lowering electricity costs for consumers. Likewise, thermal insulation reduces the air conditioning load, cutting capital costs for air conditioning equipment. Ultimately, thermal insulation reduces energy consumption that translates into savings for both residential and non-residential electricity bills. Regional countries can also benefit economically from implementing thermal insulation regulations. The reduction in electricity demand helps relieve pressure on national electricity grids, particularly during peak hours. This also reduces the demand for building new sub-stations. Further, it lowers losses in electricity transmission and distribution. Importantly, lowering electricity demand means the state does not have to spend as much money on domestic consumer electricity subsidies, ultimately leading to large savings for regional countries. By making air conditioning more energy efficient, Bahrain reduces emissions that cause environmental pollution. The decrease in pollution further improves air quality, helping the health of Bahraini residents.

In 1999 Bahrain passed legislation that required all air-conditioned buildings to have thermal insulation. Additionally, older buildings over four floors should be retrofitted with thermal insulation. As part of this policy, Bahrain's Electricity and Water Agency (EWA) published thermal insulation implementation guidelines for buildings, including specifications for construction materials, as well as requirements on the overall thermal transmittance values (U-values) for roofs (less than 0.6 W/m2-ºC) and external walls (less than 0.75 W/m2-ºC). These regulations are applied to: all external walls in a building and exposed features (for example columns, beams, stair cases and light wells or shafts), roofs, rooftop decks, and rooftop swimming pools, floors and walls exposed to the outside, as well as spandrel areas of curtain walls. In 2013, Bahrain passed a further regulation that requires all air conditioned buildings under four floors to have thermal insulation with the same specifications and requirements mandated under the previous regulation.

Bahrain's EWA ensures its thermal insulation regulations are enforced through numerous checks, audits, and inspections. All engineers working on thermal insulation are required to have a license to practice thermal installations in buildings, issued by the EWA. Construction companies and engineers are required to submit thermal insulation applications to be approved by the EWA and other bodies with complete details on plans, techniques, U-value calculations for roofs and walls, as well as the materials used. Each construction project is further required to include a copy of its license in their application for construction permission. There are numerous checks during the construction phase to monitor the progress and compliance with regulations. The EWA carries out regular audits of engineering offices and buildings as a vital part of maintaining checks on its policies and is required to maintain thermal insulation licenses.

While Bahrain's thermal insulation regulations are drastically cutting down unnecessary energy expenditure on air conditioning, additional EE measures have been implemented. In 2016, a regulation on energy labelling and minimum energy performance standards for air-conditioners was released by EWA. Bahrain's thermal insulation policies and EE regulations on air-conditioning units are helping to achieve the country's 2030 goal of reducing energy consumption by 20%.

Building Rating Systems

There are many rating systems to evaluate EE and green buildings, with several international assessment and certification system for green buildings that have been developed over the past two decades. These systems include: the BREEAM in the United Kingdom (1990), LEED in the United States (1998), and Green Star in Australia (2003). No unified assessment system for green buildings has been developed so far for the Arab region, however, individual countries or sub-regions have formulated their own methods for assessing the environmental impact of building projects.

One such regionally developed system is the Global Sustainability Assessment System (GSAS), developed in 2010 by the Gulf Organization for Research and Development (GORD). GSAS is Qatar's rating system for green buildings. While the goal of GSAS is similar to that of the LEED systems, the methodologies are different in that the former selects the bases of evaluation that are more suitable to Qatar. Similarly, the applicability of GSAS is spread across a diverse range of projects. For example, there are GSAS for mosques, which LEED does not have. There is also GSAS for rails and other such projects that are more relevant Arab countries. Based on its implementation in Qatar, Saudi Arabia, Kuwait, Jordan and Sudan may adopt GSAS as the unified regional code.

The Kuwait Green Building Council (2012) promotes both the U.S. Green Building Council's LEED green building rating system in Kuwait; and Kuwait has also signed a Memorandum of Understanding (MOU) with GORD, outlining their plan to adopt GSAS as the national code for green building. The MOU outlined an intention to engage in a common effort to implement the standards of GSAS, to contribute to the field of research and development on environmental issues, and to collaborate on the development of standard qualities of green building materials and systems.

In 2009 the Egyptian Green Building Council developed an EE rating standard for buildings, the Green Pyramids Rating System. Likewise, the Lebanese Green Building Council established the ARZ rating system in 2011 that meets minimum international environmental requirements, while taking into account local conditions. The Jordan Green Council Building was established in 2009 as a nongovernmental organization and recently published the "Guide for Green Building in Jordan." Although this guide is not an enforced code, it is expected to provide the technical standards to reach sustainability for new buildings and offer the background to produce green building codes for Jordan in the near future.

Table 14: Building Rating Systems in the Arab Region

Rating System	Country	Year of Establishment	Established By
ARZ Building Rating System	Lebanon	2011	Lebanese Green Building Council (LGBC)
Pearl Building Rating System (PRS)	UAE	2010	Estidama sustainable development initiative
Green Pyramid Rating System	Egypt	2009	The GBC of Egypt and the Housing and Building National Research Centre (HBRC). The certification levels match the LEED system. There are some unique credits in the site category encouraging the site selection in the desert outside the Nile Valley and Delta areas, the redevelopment of informal areas, and respecting historic or cultural interest.
Jordan Green Building Guide (JGBG)	Jordan	2013	Jordanian Green Building Council (GBC)
Global Sustainability Assessment System (GSAS), GSAS/QSAS	Qatar	2010	The Gulf Organization for Research and Development (GORD), in collaboration with T.C. Chan Center for Building Simulation and Energy Studies at the University of Pennsylvania, resembles BREEAM and LEED rating systems
LEED	USA	1998	USGBC
BREEAM	UK	1990	The Building Research Establishment (BRE)
Green Star	Australia	2003	Green Building Council of Australia

Dubai Super ESCO

Dubai is one of the fastest growing cities in the world; the IMF projects an economic growth rate of 3.7% for 2016, up from 3.6% in the previous year (Augustine, 2016). This fast growing economy, however, is accompanied by a rapidly increasing demand for energy and water. Dubai's water is mostly generated through high energy consuming desalination plants, as such the increasing water demand generates an additional increase in energy demand. This is clearly seen in the average yearly electricity peak demand growth of 8.31% and a yearly desalination peak water demand growth of 6.11% since 2004 (DEWA, 2015). In 2010, the Dubai Supreme Council of Energy (DSCE) - the governing body charged with ensuring the Emirate's economic growth is met with sustainable energy, water, and environmental practices - developed the Dubai Integrated Energy Strategy 2030 (DIES 2030) in order to sustainably manage the Emirate's rapidly growing demand for energy and water.

One of the most important components of the strategy of DIES 2030 is promoting energy efficiency and energy demand reduction through demand side management (DSM). The DSM strategy is divided into eight programs, of which the first is managed by Dubai Municipality, the second by Etihad Energy Services Company (Etihad ESCO) – a Super ESCO - and the rest by various Dubai organizations (Etihad, 2014).

- Building regulation
- Building retrofits
- District cooling
- Standards and labels for appliances and equipment
- Water reuse and efficient irrigation
- Outdoor lighting
- Change of tariff rates
- Demand response

Etihad ESCO was established in 2013 by the Dubai Electricity and Water Authority (DEWA) to facilitate energy efficiency construction projects and to overcome institutional and financial market barriers. Super ESCOs act as a means of facilitating and overcoming institutional and financial market barriers that hinder the implementation of large-scale energy efficiency projects. Etihad ESCO's contractual model is called Energy Performance Contracting (EPC). An EPC is based on the premise that the client or owner will pay-back the initial investment made to the EPC contractor through the generated savings made over a certain period of time. In return, the EPC contractor or Energy Service Company (ESCO) will guarantee those savings through its various Energy Conservation Measures (ECMs). After the initial investment is paid-off to the loaning institution, the owner will then start to benefit from the financial savings generated through lower water and electricity bills (Etihad, 2014).

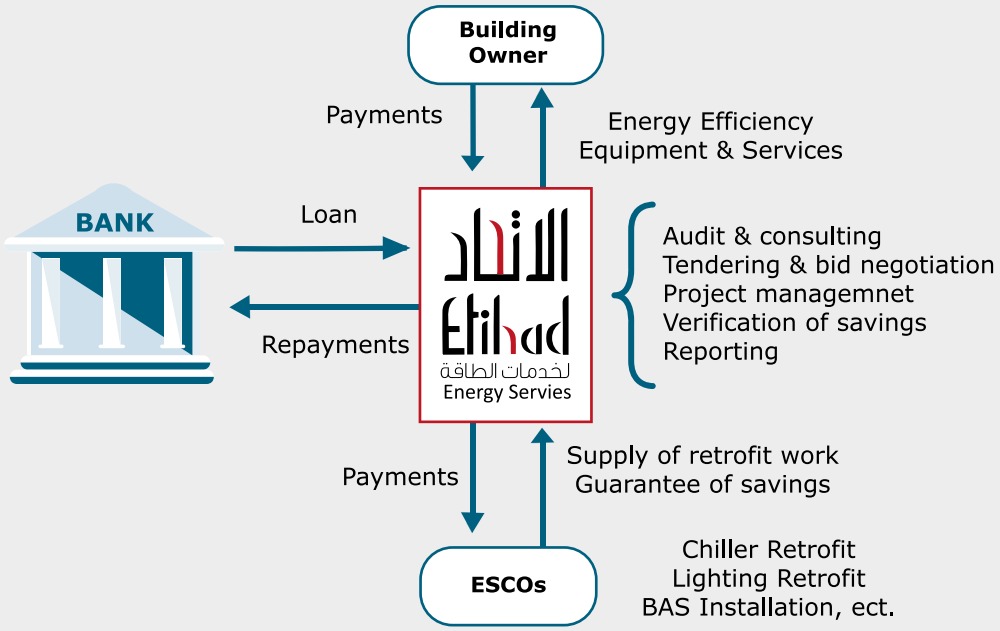
The Etihad Super ESCO aims to enable the EPC market in Dubai by:

- Prequalify target buildings through data analysis, site visits, and project feasibility study
- Managing the tendering process on behalf of the owners and select the winning offer
- Facilitating access to financing for the owner through financial institutions
- Following up on project execution with the designated ESCO
- Managing owner-ESCO contracts, including the ESCO's measurement and verification plans, and finally confirm that the savings guaranteed by the ESCO are achieved

The ESCO market in Dubai is regulated by the Dubai Regulatory and Supervisory Bureau for Electricity (Dubai RSB), as such each ESCO in Dubai interested in the EPC retrofitting program is obliged to obtain an initial accreditation through the RSB accreditation scheme. As of November 2016, 19 ESCOs have been accredited under the RSB accreditation scheme, of which 6 are fully accredited and 13 hold provisional accreditation. The regulatory framework is also responsible for providing a standard for EPC contracts, establishing guidelines for the ESCOs measurement and verification process, and providing dispute resolution mechanism (RSB, 2016).

The Figure Below Describes the Etihad Super ESCO EPC business model (Etihad,2014).

Etihad ESCO Business Model (Etihad, 2015)



DIES 2030's second program, managed by Etihad ESCO, seeks to retrofit existing and inefficient buildings; it has set the ambitious goal of retrofitting 30,000 of the 120,000+ buildings in Dubai by 2030. The Super ESCO's additional 2030 goals include: an annual saving of 1.7 TWh of electricity, 5.6 BIG (Billion Imperial Gallons) of water saved annually, and 1 million tons of CO2 emission prevented in almost 30,000 public retrofitted buildings per year.

As of March 2016, Etihad Super ESCO has been involved in a US$ 4.36 million project involving 7 DEWA buildings, which have achieved an annual electricity reduction of 5 GWh (31% reduction) or US$ 0.71 million and curbed 2,245 tons of CO2 emissions. The payback period for the initial Dhs 16 Million investment made by DEWA is expected to be six years (Etihad, 2015). A second successful Super ESCO supported project involved replacing 8,500 lighting fixtures in DEWA power stations with LED lighting that will achieve a 68% reduction in energy consumption, equivalent to 14 GWh in annual energy savings and 6,286 tons of CO2 emissions avoided. The payback period through savings of the initial Dhs 21 million investment made by DEWA is expected to be three and a half years (Etihad, 2015). In November 2015 Etihad Super ESCO announced a building retrofit project that will target 157 buildings in the Jebel Ali Free Zone and is estimated to save 26 GWh of electricity a year, as well as 200 million imperial gallons of water, resulting in $6 million in savings.

3.2.3. Statutory Obligation to Install Solar Water Heaters

Solar water heaters are a relatively low cost and effective measure to integrate renewable sources of energy in a building system, thereby improving a building's energy efficiency. While solar water heaters are popular in several countries, most notably Palestine, many regional states do not have mandatory regulations on solar water heaters, as can be seen in Table 15. Given the limited number of states with policies regarding solar water heaters, this is an area with room for improvement. Jordan and the UAE have the most comprehensive and mandatory solar water heater policies in the region by requiring their installation in new buildings. The Jordanian policy requires the installation of solar water heaters in new buildings exceeding 250 m2, in apartments exceeding 150 m2, and in offices exceeding 100 m2 (Article 10, Bylaw No 73). In the UAE. solar water heaters to provide 75% of domestic hot water requirements in all new buildings.

Table 15: Mandatory Installation of SWH

Country	Policy
Algeria	There are currently no mandatory building mandates, such as the installation of solar water heaters in new buildings put in place.
Egypt	A ministerial decree (401/1987) was issued by the Minister of Housing to make the installation of solar water heating systems in new governmental buildings in new communities compulsory. However, the decree has not been enforced until now.
Jordan	Solar water heaters are mandatory for all new buildings according to Article 10 of the bylaw No. 73 (2012), which obliges mandatory installation of Solar Water Heaters effective from 1 April, 2013 for new apartments exceeding 150 m2, as well as for offices in commercial buildings exceeding 100 m2, and for buildings exceeding 250 m2.
Morocco	No building mandates exist for solar water heaters, such as mandatory installation in new buildings.
Palestine	Solar water heaters are so popular in Palestine that it is almost considered a default item when planning new building constructions. No building obligations and mandates related to solar water heaters exist.
Sudan	To date, no statutory obligation to install solar water heaters exist in Sudan.
Tunisia	The law passed by the Tunisian government in 2005 mandated the use of solar water heater systems in new public buildings. (WEI)
UAE	It is mandatory for at least 75% of the overall needs of the hot water in the building the be heated with solar water heaters. In the case of swimming pools, the water heating system should have a capacity of not less than 50 % of the total capacity required.http://www.emirates247.com/news/emirates/solar-heaters-made-a-must-have-2011-12-06-1.431511
Syria	Law No. 17/2013 on the establishment of the domestic solar heating fund at the Ministry of Electricity

Reference: UNEP

Mandatory

Existing Regulation, No Mandates

Not Mandatory

3.2.4. Phase-out of Inefficient Lighting and Appliances

3.2.4.1 Lighting

As lighting is responsible for nearly 34% of electricity consumption in the Arab region (AFED, 2014), it is estimated by the UNEP/GEF en.lighten initiative that switching from incandescent lightbulbs to CFLs would save around 37.8 TWh of electricity and prevent the emission of 24.8 Mt of CO_2 (AFED, 2014). The lighting sector constitutes the largest consumption of electricity in both Algeria and Sudan at 41.3% and 35.5%, respectively (enlighten, n.d.). As Saudi Arabia and Egypt are the two highest electricity consumers in the Arab region, consuming nearly 47% of the region's total electricity consumption, EE initiatives are an important opportunity for energy saving in the lighting sector. Lighting in Egypt, for example, shares the highest electricity consumption and accounts for 25% of the total energy consumed in the country. Lighting consumes almost 43% of the total energy use in the residential and commercial sectors and 10% in the industrial sector (MoE, 2015). A study by en.lighten and UNEP in 2010 demonstrated that switching to energy efficient lighting would result in almost 292.5, 289.6, and 262.8 million US dollars in energy savings for Egypt, Saudi Arabia and Morocco, respectively; this would lead to 7, 12.2 and 2 TWh savings in annual electricity consumption, respectively for these countries (enlighten, n.d.). Lebanon and Tunisia, with some of the highest shares of electricity consumption in the lighting sector, both have a potential of saving almost 1 TWh of electricity by switching to energy efficient lighting.

As seen in Table 16, most Arab countries have adopted policies to phase out inefficient lighting. Lebanon has adopted a strategy to ban the import of all incandescent lightbulbs and implement a comparative labeling system for CFL lamps. Jordan will start phasing out inefficient domestic lamps, including incandescent low efficiency halogen lamps by January 2016. The UAE issued an import ban on all incandescent lightbulbs that came into effect on January 2015 and is expected to save the country $182 million US$ in electricity bills. Egypt developed mandatory energy labels for CFLs and plans to ban the sale of incandescent lightbulbs by 2020 (enlighten, n.d.).

Table 16: Policies to Phase-out Inefficient Lighting (2016)

Country	Policies	Status
Algeria	Mandatory EE labeling of EE lightbulbs for residential use adopted by the Decision of Ministry of Energy and Mines on February 21, 2009. (AFEX, 2015)	Adopted
	Bulk procurement and subsidization of CFLs and awareness raising	
Bahrain	Minimum energy performance standards have been developed for household lightbulbs based on the EU Commission Regulation No 244/2009 (AFEX, 2015)	
	Notified all local vendors/clearing agents that lamp regulation (Regulation for Non-Directional Household Lamps – Ministry of Industry & Commerce Order no. 3/2015) has been enforced since September 2015 for import of certain lamps. Effective June 2, 2016, all vendors must apply through customs OFOQ system before placing the order/importing them in Bahrain. Following documents are required to be uploaded through OFOQ. (OFOQ, 2016)	Adopted
Djibouti	Awareness raising on the use of energy saving lighting equipment (low energy bulbs) in residential areas (Distribution of 5 million low energy lightbulbs)	
	Audit of administrative buildings; diagnostic review of the lighting and air conditioning systems used in different administrative buildings (Djibouti, 2015)	
Egypt	Plans to ban the sale of all incandescent lamps by 2020 Phase out all ≥ 25W incandescent GLS lightbulbs by 2015	
	Mandatory labels for compact fluorescent lamps (CFL)	Adopted
	Ministerial Decree no. 975/2014 mandates Egyptian Standard ES 7823/2014 'Energy Efficiency Requirements for Electrical Lamps'. ES7823/2014 establishes requirements for labeling and providing supplementary product information and energy efficiency requirements for electrical lamps, such as: filament lamps, fluorescent lamps, compact fluorescent lamps, high-intensity discharge lamps & LEDs. The standard is allegedly in conformity with European directive (EU) No. 1194/2012, (EU) No. 874/2012. (MELA N. o., 2016)	
	Developing an energy efficiency plan and using LED in all new cities (Hend, 2016)	
Iraq	Non-existent	Non-existent

Country	Policies	Status
Jordan	Technical regulations for lighting products with minimum EE classification requirements (AFEX, 2015)	
	Regulation # 2091/2013, which is part of a suite of technical regulations on eco design & energy labeling of electrical products, will start phasing out inefficient domestic lamps including incandescent, low efficiency halogen lamps. The regulation entered into force on January 1, 2016. No mandatory pre-registration of products is required. Companies can register on a voluntary basis and can expect a smoother process with customs clearing. (Middle East Lighting Association, 2016)	Adopted
Kuwait	It is mandatory to install and replace all lighting systems in government buildings with LED lights with occupancy sensors and/or time-of-day-control in the lighting systems/fixtures. Discharge and LED lamps shall have a minimum power factor of 0.9.	Prepared
Lebanon	National comparative label for CFLs was adopted by the Lebanese Center for Energy Conservation (LCEC). The labels are planned to be updated regularly. (enlighten, Lighting Global Map, Lebanon)	
	Banned the import of incandescent lamps as part of a CDM project (enlighten, Lighting Global Map, Lebanon)	
	Setup and implementation of a plan for public street lighting. This measure aims at developing and setting-up a multi-level plan for the management of public street lighting, including implementation of energy efficient solutions.	Adopted
Libya	Non-existent	
Mauritania	Non-existent	Non-existent
Morocco	Mandatory energy labeling of household electric lamps. (AFEXEE, 2015)	Adopted
Oman	Non-existent	Non-existent
Palestine	Non-existent	Non-existent
Qatar	Qatar General Electricity & Water Corporation (KAHRAMAA), through the National Program of Conservation and Energy Efficiency (Tarsheed) and with the coordination of Ministry of Municipality and Environment and other concerned entities, has succeeded in enacting a government regulation to prevent all types of import and sale of high glowing incandescent tungsten bulbs (75 and 100 Watts) in the State of Qatar starting May 1, 2016. (KAHRAMAA, 2016)	
Saudi Arabia	The Saudi Energy Efficiency Program (SEEP) is in the process of drafting regulations, which focus on the phase out of least efficient light sources in residential and commercial/professional lighting (AFEX, 2015)	Not-adopted
	The Saudi Standard SASO 2870/2015, which was published in June 2015, came into force in August 2016. The standard covers the energy efficiency, functionality, and labeling requirements for indirect and direct general light sources with a luminous flux above 60 lumens and below 12000 lumens in two stages: - First stage: From May 1, 2016 a lamp with a power equal to 60 Watt or above - Second stage: From May 1, 2017 will cover all lamps below, equal and above 60Wat Regulated lightbulbs include the following: Incandescent lamps Compact fluorescent lamps with integrated ballast (CFLi) Halogen lamps Light-emitting diode (LED) lamps (Incandescent retrofit types) Light-emitting diode (LED) lamps (Halogen retrofit types)	Adopted
Sudan	None	Non-existent
Syria	The Energy efficiency building code is under preparation	Non-existent
Tunisia	Joint order of the Ministry of Industry and Technology and the Ministry of Commerce and Handicraft of August 18, 2010 prohibits the sale of incandescent lightbulbs with power superior or equal to 100 W. In 2012 incandescent lamps with power of 75 W and 60 W were planned to be phased out. In 2013 incandescent lamps with power of 40 W and 25 W were planned to be phased out, however the phase out has been delayed.	Adopted
	Mandatory energy labeling of EE lamps (AFEX EE 2015)	

Country	Policies	Status
UAE	The Indoor lighting standard introduced by the Emirates Authority for Standardization and Meteorology (ESMA) has banned the import of inefficient lightbulbs. The standard imposed an import ban on incandescent lamps from 1 July 2014 and a sales ban from January 1, 2015. ESMA's requirements include: electrical safety, energy efficiency, and energy labeling, functionality, limits on hazardous chemicals and safe disposal. The retailers and wholesalers have been given a period of 6 months to sell their current stock of inefficient bulbs. The new standard will result in annual savings of AED668mn equivalent to 940,000 tons of carbon emissions prevented, of which AED452mn ($123mn) will be saved by households each year. In total, the regulation is expected to save 350 – 500 MW a year.	Adopted
	All lighting products (within the scope of the regulation) entering the UAE or manufactured locally, must meet the Minimum Energy Performance Standard (MEPS) and comply with the Emirates Conformity Assessment Scheme for low voltage equipment. (MELA, 2015)	
Yemen	Establishment of a legal and institutional framework to facilitate the implementation of a project to promote the adoption of CFLs in government buildings, supported by Nationally Appropriate Mitigation Actions "NAMA"	Prepared

3.2.4.2 Appliances

Buildings account for 35% of the total final energy consumption in the Arab region (AFED, 2014). Air conditioning is the largest consumer of energy in the building sector, especially in the GCC. In Saudi Arabia and the UAE, air conditioning alone consumes 70% of buildings' total energy consumption. The market for air conditioners is expected to increase at a rate of 5.5% between 2016 and 2020 in North Africa. The GCC is expecting a 7.3% growth rate increase in the market for air conditioners, especially as the region will hold the 2020 Expo and 2022 FIFA World Cup. Peak electricity demand has increased by 70%, 44%, 43%, 35% and 34% in Sudan, Algeria, Oman, Qatar, and Egypt, respectively, between 2011 and 2015 (AUE, 2015). The peak demand times in the majority of the Arab countries exists during the summer period.

As most of the electricity consumption in the Arab region is used in the residential sector, adopting mandatory energy labels and Minimum Energy Performance Standards (MEPS) is an important step to increase the energy efficiency of appliances available in the market. Adopting mandatory MEPS for appliances would ensure that only energy efficient equipment can enter the market, thus gradually eliminating the existence of any inefficient appliances.

Many countries in the region have developed at least some policies for either MEPS or labeling of appliances, as can be seen in Table 17. Roughly half of the countries in the region have policies regarding MEPS for appliances, of which most are unevenly applied. Many countries have MEPS and labeling requirements that are mandatory for some appliances and not others, which limit the effectiveness of such measures. Given the region's hot climate, most of these MEPS are for air-conditioners and refrigerators. Tunisia, UAE, Saudi Arabia, Jordan, and Egypt have regulations that stipulate mandatory MEPS for a wide array of appliances, including washing machines. Despite the presence of such measures, many of these standards are not fully enforced. Although the region still lacks the adoption of mandatory energy labels for various appliances, many countries are developing new MEPS and label comparative policies.

Table 17: Standards and Labeling for Household Appliances (2016)

Country	Policy Type	Products/ Household Appliances	Mandatory/ Voluntary	Status
Algeria	Label Comparative	Refrigeration & freezers	Mandatory	Entered into force in 2010
		Heating, ventilation, and air conditioning	Mandatory	Under revision (2010)
		Lighting	Mandatory	Entered into force in 2010
Bahrain	MEPS	Heating & Air conditioning	Mandatory	Adopted 2016
		Lighting	Voluntary	-
	Label Comparative	Heating & Air conditioning	Mandatory	
Djibouti		None	n/a	-
Egypt	MEPS	Heating & Air conditioning	Mandatory	Entered into force in 2003
		Electric water heaters		Entered into force in 2007
		Refrigerators and freezers		Entered into force in 2006
	Label Comparative	Refrigerators and freezers	Mandatory	Entered into force in 2006
		Heating & Air conditioning	Mandatory	-
		Lighting	Mandatory	-
		Washing machines	Mandatory	
Iraq	-	-	-	-
Jordan	MEPS	Refrigerators and freezers	-	Entered into force in 2013
		Washing machine and clothes dryer		Entered into force in 2013
		Dishwasher		Under development (2014)
		Lighting		Entered into force in 2013
	Label Comparative	Refrigerator and freezer	Mandatory	Entered into force in 2013
		Dishwashers and dryers		

Country	Policy Type	Products/ Household Appliances	Mandatory/ Voluntary	Status
Jordan	Label Comparative	Heating & Air conditioning	Mandatory	Entered into force in 2013
		Washing machine		
		Lighting		
Kuwait	MEPS	Heating and air conditioning	Mandatory	Adopted (1983)
Lebanon	Comparative labeling	Heating and air conditioning	Voluntary	Adopted 2016
		Refrigerators		
		CFL		Adopted in 2014
	MEPS	CFL (incandescent lamps are banned in the market)	Mandatory	2014
Libya	-	-	-	-
Mauritania	-	-	-	-
Morocco	MEPS	Heating and air conditioning	Mandatory	-
	Comparative labeling	Refrigerators	Mandatory	-
		Heating and air conditioning		
		Lighting		
Oman	MEPS	Heating and air conditioning	-	-
		Lighting		
Palestine		None Existent		
Qatar	MEPS	Heating and air conditioning	Mandatory	-
		Lighting		
	Label Comparative	Heating and air conditioning	Mandatory	-
Saudi Arabia	MEPS	Heating and air conditioning	Mandatory	Entered into force in 2013
		Refrigerators		
		Freezers		
		Lighting		
	Label comparative	Heating and air conditioning	Mandatory	Entered into force in 2013
		Washing machines		
		Refrigerators and Freezers		
Sudan	-	-	-	-
Syria		CFL and linear fluorescent lamps	Voluntary	-
		Refrigerators	Mandatory	
Tunisia	MEPS	Heating & Air conditioning	Mandatory	Entered into force in 2009
		Refrigerators and freezers		Entered into force in 2014
		Lighting		
	Label Comparative	Refrigerators and freezers	Mandatory	Entered into force in 2004
		Heating & Air conditioning		Entered into force in 2009
		Lighting		Entered into force in 2014
UAE	MEPS	Heating & Air conditioning	Mandatory	November, 2016
	Label Comparative	Refrigerator and freezer	Mandatory	December, 2013
		Heating & Air conditioning	Mandatory	November, 2016
		Washing machine, Cloths dryer	Mandatory	Entered into force in 2013

Country	Policy Type	Products/ Household Appliances	Mandatory/ Voluntary	Status
UAE	Label Comparative	Lighting (incandescent)	Mandatory	Entered into force in 2012
		Lighting: fluorescent (CFL and other), halogen, solid state lighting/LEDs (self-ballast), and incandescent	Mandatory	Under development
Yemen	-	-	-	-

Source: CLASP

3.2.5 Industrial EE Policies

The petrochemical industry is the largest industry in the Arab region, particularly in the fossil fuel rich gulf countries. The capacity of the petrochemical industry in the GCC has been increasing by around 9.5%/year since 2008. On the other hand, energy importing countries rely less on the petrochemical industry. For example, Lebanon's major industries are banking, food processing, and cement. Tunisia's major industries include textile and leather manufacturing.

Most Arab countries still do not have comprehensive industrial EE policies; only seven Arab states have such policies, some of which are not fully enforced. There are three main forms of regulations to reduce industrial energy consumption in the region: mandatory checks and audits, energy consumption reporting, and assigning oversight managers to enforce policy.

Many countries have cut-off points; whereby mandatory regulations apply if industrial energy consumption is greater than a specified amount. For instance, Egypt's regulations apply to industries that have a contracted demand over 500 kW, Lebanon enforces regulations for industries with consumption over 400 toe/year, and Tunisia's policies are aimed at pre-existing industries that consume over 800 toe/year. Egypt, Jordan, Lebanon, Morocco, and Tunisia have mandatory energy audits for high-consumption industries.

Tunisia has the most comprehensive set of policies regarding EE for the industrial sector in the region. For existing industries, industrial establishments that consume over 800 toe/year are required to have energy audits, dedicated energy managers, and annual energy reporting. For new industries, the law mandates prior consultation with the ANME. Tunisia is also the only country to require prior ministerial authorization before the commencement of any industrial project with a projected annual energy consumption of over 7,000 toe/year.

Given that few countries have industrial EE policies and the present limitations of the extant policies, this area has room for improvement.

Table 18: Industrial EE Policies

Country	Policies
Algeria	Executive Decree No. 05-495 (2005), which was modified and completed by Decree No. 13-424 (2013)
	For industrial establishments whose total energy consumption exceeds 2,000 toe
	• Mandatory energy audits
	• Mandatory energy management system
	• Mandatory energy reporting every three years
Bahrain	No policy, however, Bahrain is working with UNDP on establishing a national energy policy paper and framework for national energy strategy that will cover all sector in line with economic vision 2030.
Djibouti	No EE policy, however, one of the objectives of ADME is promoting energy efficiency actions for industrial equipment and implementing state policy in the field of energy efficiency.
Egypt	According to the new electricity law, industries whose contractual capacity exceeds 500 KW shall appoint officials to be assigned to improve the power usage efficiency and keep a power register.
Iraq	None
Jordan	The Bylaw No 73 (2012) on Regulating Procedures and Means of Conserving Energy and Improving its Efficiency issued by virtue of Article (18) of the Renewable Energy and Energy Efficiency Law No 13 (2012).
	Any entity, whose annual energy consumption exceeds 50 toe per year and all public entities regardless of their consumption shall be subject to the mandatory and periodic energy audit carried out by the licensed entities.
Lebanon	Draft energy conservation law provides for mandatory energy audits for establishments whose annual energy consumption exceeds 400 toe.
Morocco	Law No 47-09 applies to energy intensive industries to undergo mandatory energy audits. Article 16 of the Law further stipulates that "modality of applications will be fixed by regulations". No such regulation has been adopted yet.

Country	Policies
Tunisia	Decree No 2004-2144 (2004), as amended by decree No 2269-2009 of July 31, 2009:
	For industrial establishments with annual energy consumption exceeding 800 toe
	• Mandatory energy audits
	• Mandatory dedicated energy manager
	• Mandatory energy reporting system every year
	For new industrial projects whose total projected energy consumption exceeds 800 toe
	• Mandatory prior consultation with ANME
	For new construction projects for residential and tertiary sectors whose total projected energy consumption exceeds 200 toe
	• Mandatory prior consultation with ANME
	For new industrial projects or expansion of existing industrial facilities whose total projected energy consumption exceeds 7,000 toe
	• Prior authorization from the ministry in charge of energy

"Pan Arab- Certified Energy Management Professional" Program (PA-CEMP)

The Certified Energy Management Professional (PA-CEMP) plan is an in-depth professional certification program for energy managers, tailored for the Arab region. RCREEE, in collaboration with League of Arab States Energy Department, saw the need to introduce the "Certified Energy Management Professional" program (PA-CEMP). It was endorsed by the Executive Bureau of the Arab Ministerial Council of Electricity in their 32nd session on May 31, 2016.

It aims to assist EE policy makers and program administrators in planning and implementing Energy Efficiency plans and related measures. Through a recognized certificate, energy management professionals will be equipped with the latest technologies, energy essentials and the effective means with solutions to reduce energy consumption in a cost effective approach to achieve energy targets in line with Article 7 of the Arab EE Guideline.

PA-CEMP is designed for experts and managers of various specialties, degrees, and experiences. Even fresh graduates will be able to obtain "Associate Energy Management Professional" Certificate until s/he acquires the required years of experience.

PA-CEMP
Pan Arab Certified Energy Management Professional

3.2.6. Sustainable Transport Policies

After China, India and the United States, the Arab region has the world's fourth highest total CO_2 emissions, as well as the second largest growth in CO_2 emissions in the transport sector from 1990 – 2009. Saudi Arabia, Egypt, and the United Arab Emirates have the highest CO_2 emissions in the region. In 2010, Saudi Arabia – with CO_2 emissions exceeding 100 million tons - had higher volumes of CO_2 emissions from the transport sector, compared to all other regional countries. Furthermore, the transportation sector contributed to the highest percentage of CO_2 emitted in 2010 in Libya, Algeria, Morocco and Tunisia at 60%, 37%, 36%, and 34%, respectively (ESCWA, 2013).

The increasing development in the transport sector is a consequence of the rapid population growth in the region, which has seen an 11% population increase from 2010 to 2015. The regional increase in road vehicles has been met by rising air pollution, road traffic casualties, and additional stress on fossil fuel extraction and depletion. Such problems are a result of many Arab countries' lack of adequate public transportation services, poor quality road infrastructure, aging vehicle fleets, as well the lack of appropriate environmental policies and regulations in the transportation sector.

It is crucial for Arab states to improve EE in the transport sector, as it is the largest consumer of petroleum products and a significant contributor to air pollution in the region. Improvements can be made by developing stricter energy efficiency requirements for transportation vehicles, improving the public transportation sector, and establishing vehicle emission standards in the region.

The Sustainable Transport Policies section provides a general snapshot of the transportation sector in the Arab region, showcasing the quality of the transport infrastructure, changes in the volume of road vehicles, as well as the policies and projects in the region to sustainably develop the transportation sector.

3.2.6.1 Trends in Transportation across the MENA Region

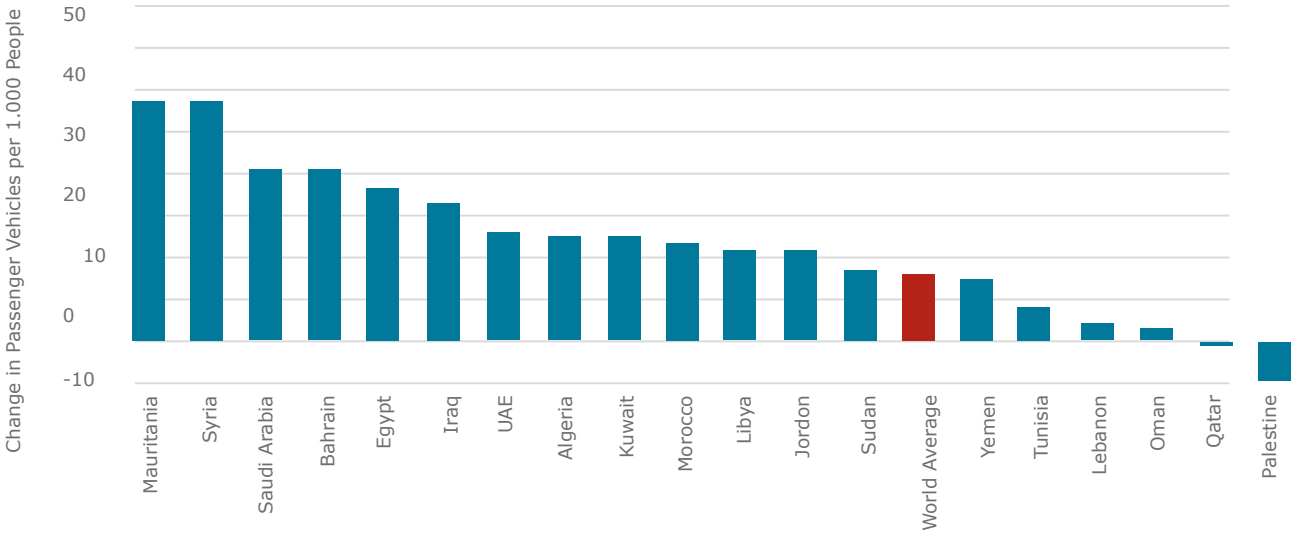
Table 19: Vehicle Specification Case Study from Four Arab Countries

Country	Average Engine Size in 2012 Sales (L)	Average Annual Fuel Economy of New LDVs (L/100km)	Average CO_2 Emission Rates, All New LDVs (gCO_2/km)	Taxable Horsepower
Bahrain	1.7	11.1	229.6	The Traffic Law in Bahrain sets the vehicle weight as basis for the annual registration fees, distinguishing between two categories only with regard to passenger vehicles (<2.5 tons and > 2.5 tons)
Egypt	1.6	7.28	170	Tariff rates imposed on imported passenger cars (CBUs) vary according to engine size. The tariffs currently range from: • 40% for passenger cars of capacity up to 1600 cc to 135% for those above 1600 cc. • Sales taxes also follow a similar logic, where cars with engine sizes up to 1600 cc are subject to 15% sales taxes, while those above 1600 cc are subject to 30% sales taxes, or 45% if they are imported (CBUs) (AMCHAM 2010). • Passenger cars with large engine sizes are seen as luxury goods and hence the higher tariff rate and sales taxes.
Morocco (2013)	1.5	4.86	125.9	• Vehicles are subject to a special annual tax on their motor engine upon their first registration in Morocco (MEF, 2014). The tax is detailed as follows: • A fixed fee of 50 dirham (approx. 4.5 Euros) per unit horsepower • A fixed fee, determined by the fiscal power and price of the vehicle
Tunisia	1.3	5.37	134	• A high consumption tax is imposed on automobiles with large capacity engines purchased through authorized distributors, 67% for gasoline engines, and 88% for diesel engines. • A higher consumption tax is imposed on automobiles with large capacity engines that are not purchased through authorized distributors, up to 277% for gasoline engines, and 360% for diesel-fueled engines.
EU 2015 targets		5.6	130	

Source: CEDARE, 2015

Table 19 illustrates four case studies conducted in Bahrain, Egypt, Morocco, and Tunisia in 2015 by the Center for Environment and Development for the Arab Region and Europe (CEDARE) on fuel economy and CO_2 emissions trends of new light-duty vehicles (LDVs). Bahrain has the highest average CO_2 emission/km from all new LDVs, due to the use of vehicles with large engine sizes that are not very fuel efficient. When comparing these four countries, the most energy efficient LDVs were sold in Morocco and Tunisia. While the EU's 2015 vehicle emission targets are set at 130g of CO_2 emitted/km and 5.6L/100km of fuel consumption for LDVs, the average annual fuel economy and average CO_2 emissions of LDVs sold in Tunisia in 2012 were similar to the EU's 2015 targets and were lower for new LDVs sold in Morocco in 2013. These case studies indicate that Morocco and Tunisia are on the right track to put into place effective policies and incentives to promote the use of energy efficient vehicles and reduce CO_2 emissions from the transportation sector.

Figure 15: Changes in Passenger Vehicles Across the Arab Region (2009-2013)



The Arab region has witnessed a significant increase in passenger cars per 1000 people between the period of 2009 and 2013. Mauritania and Syria saw the largest increase in passenger cars, with a 39% increase in the above-stated time period. The entire Arab region, with the exception of Lebanon, Oman, Palestine, Qatar, and Tunisia, has a higher increase in passenger cars per 1000 people than the average EU-28, with a cumulative increase of 5% during the 2009 - 2013 period. This rapid increase in passenger cars is mainly due to population growth, the improved standard of living, the lack of policies and incentives encouraging public transportation, as well as the expanding transportation infrastructure in the region that is either inefficient or non-existent in many countries. Furthermore, the low price of vehicle fuels in most countries plays an important role in discouraging people from using public transportation as means of reducing their transportation costs.

The transportation sector was responsible for 22% of global carbon dioxide (CO_2) emissions worldwide in 2010 (IEA, 2010). In the Arab region, the transport sector is growing rapidly; in seven Arab countries growth in this sector has doubled and in six countries growth have increased by more than 100% from 2000 to 2010. As such, applying environmental and energy efficient regulations and policies to the transport sector would greatly reduce the region's carbon footprint and aid Arab countries toward achieving their nationally determined contributions to combat climate change.

3.2.6.2 Vehicle Emissions Standards

The significant rise in vehicle emissions in the region has a hazardous impact on public health. For example, Lead from transportation fuel is considered the main source of Lead poisoning in the world. Lead exposure can affect various organs, cause nervous system damage, cardiovascular problems, and can lead to decreased kidney function. Furthermore, lead poisoning is particularly harmful to children and can cause lower IQ levels and learning problems, hearing problems, anemia and slowed growth (WHO, 2016). Algeria, Iraq, and Yemen remain the only three countries globally that haven't phased out Leaded gasoline.

Sulfur in diesel is responsible for forming sulfur dioxide (SO_2) and sulfate (SO_4) during combustion. These particulate matter pollutants can have severe health effects, particularly on the respiratory system and can cause eye irritation. Moreover, SO_2 emissions are directly linked to the formation of acid rain when it combines with water to form sulfuric acid. Table 20 shows the sulfur levels in diesel fuel in the Arab region. Developed countries have maintained fuel sulfur levels of less than 15 ppm; and Morocco is the only regional country with comparative international sulfur levels. The highest levels of sulfur in diesel (more than 5,000 ppm) can be seen in Egypt, Iraq, Palestine, and Syria. In general, sulfur levels in diesel in the Arab region, with the exception of Morocco, remains at higher levels than in the rest of the developing world.

Table 20 further shows the applied vehicle emission standards in the Arab region, which clearly indicates that the majority of the Arab countries still lack any significant emission standards for vehicles. The vehicle emission standards, indicated in Table 20, are based on the European emission regulations. Each Euro standard refers to a certain emissions concentration limit for different pollutants, such as carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides (NOx), and particulate matter (PM). Euro 1 was approved in 1992, Euro 3 in 2000, and Euro 6 in 2014, with every update having lower limits on these pollutants (more information can be found in annex 2).

Table 20: Vehicle Emission Standards Across the Arab Region

Country	Phasing out Leaded Gasoline in the Arab Region	Diesel Fuel Sulfur Levels (ppm)	Vehicle Emission Standards
Algeria	Leaded and unleaded	500 - 2000	Euro 3
Bahrain	Unleaded	50 - 500	No policy
Djibouti	Unleaded	2000 - 5000	-
Egypt	Unleaded	> 5000	Below Euro 3
Iraq	Leaded and unleaded	> 5000	-
Jordan	Unleaded	2000 - 5000	Euro 3
Kuwait	Unleaded	50 - 500	No policy
Lebanon	Unleaded	500 - 2000	No policy
Libya	Unleaded	500 - 2000	-
Mauritania	Unleaded	500 - 2000	-
Morocco	Unleaded	< 15	-
Oman	Unleaded	15 - 50	No policy
Palestine	Unleaded	> 5000	Euro 3
Qatar	Unleaded	50 - 500	
Saudi Arabia	Unleaded	500 - 2000	Below Euro 3
Sudan	Unleaded	50 - 500	-
Syria	Unleaded	> 5000	-
Tunisia	Unleaded	15 - 50	-
UAE	Unleaded	50 - 500	-
Yemen	Leaded and unleaded	500 - 2000	No policy

Table 21: Vehicles Import Regulations

Country	Import Ban on Old or Secondhand Vehicles
Algeria	Vehicles 3+ years old are banned
Bahrain	Vehicles 5+ years old are banned for private vehicles, motorcycles, and private transportation 10+ years for buses, trucks, trailers, and semi trailers
Djibouti	Non-Existent
Egypt	Vehicles 3+ years old are banned; all imported cars must have catalytic converter
Iraq	-
Jordan	Vehicles 5+ years old are banned
Kuwait	Vehicles 5+ years old are banned
Lebanon	Vehicles 8+ years old are banned (Law Number 150, 192)
Libya	Vehicles 5+ years old are banned (libyaaljadidah, 2013)
Mauritania	For small vehicles, +8 years old are banned For big vehicles, +12 years old are banned (afrigatenews, 2014)
Morocco	Vehicles 5+ years old are banned
Oman	Vehicles 7+ years old are banned Trucks 10+ years old are banned (Alnaseri, 2015)
Palestine	Vehicles 3+ years old are banned
Qatar	Vehicles 5+ years old are banned
Saudi Arabia	Vehicles 5+ years with consumption less than 10.3 liters/km are banned Light trucks 5+ years with consumption less than 9 liters/km are banned Heavy trucks 10+ years are banned
Sudan	Ban on all imported used vehicles with the exception of diplomatic, envoys, rentals and expatriates according to the following rules: - 5+ years old banned - Maximum of 1 imputed vehicle - Maximum of 1 vehicle per lifetime
Syria	Vehicles 2+ years old are banned
Tunisia	Touristic vehicles 3+ years old are banned 5+ years for commercial vehicles with a gross of less than 3.5 tons are banned
UAE	-
Yemen	Vehicles 10+ years old are banned (Law, 2012)

3.2.6.3 Quality of Transportation Infrastructure in the Arab Region

Based on the World Energy Forum's Global Competitiveness Report, Table 22 indicates the quality of transportation infrastructure (road, railroad, port, and air) in the Arab region, with the exception of Djibouti, Libya, Sudan, and Syria due to the unavailability of data or their current political situation. The scores in the table range from 1 to 7; a score of 1 reflects extremely poor and underdeveloped transportation infrastructure and a score of 7 indicates a highly developed transportation infrastructure, according to international standards. As seen in Table 22, the Arab region generally has moderately good quality transportation infrastructure, with the exception of Yemen and Mauritania that have scores reflecting relatively poor quality transportation infrastructure. United Arab Emirates, Qatar, and Bahrain have the most efficient road infrastructure in the region and rank among the leading countries in well-developed transportation infrastructure.

Table 22: Quality of Transport Infrastructure in the Arab Region

Country	Quality of Roads	Quality of Railroad Infrastructure	Quality of Port Infrastructure	Quality of Air Infrastructure
Algeria	3.2	3	3.2	3.2
Bahrain	5.1	-	5.1	4.9
Djibouti	-	-	-	-
Egypt	3	2.6	4.3	4.8
Iraq	-	-	-	-
Jordan	4.3	2.5	4.5	5.3
Kuwait	4.4	-	4.1	3.6
Lebanon	2.8	-	3.8	4.1
Libya	-	-	-	-
Mauritania	2.3	2	2.9	2.4
Morocco	4.4	3.9	4.8	4.7
Oman	5.5	-	4.6	4.7
Palestine	-	-	-	-
Qatar	5.1	-	5.5	6.2
Saudi Arabia	4.9	3	4.6	4.9
Sudan	-	-	-	-
Syria	-	-	-	-
Tunisia	3.5	1.6	2.5	3.2
United Arab Emirates	6.5	-	6.4	6.7
Yemen	2.5	-	2.6	2.2

Source: The Global Competitiveness Report

According to the World Health Organization's (WHO) global status report on road safety, Table 23 outlines Arab state's policies to assure the quality of road infrastructure and promote the use of public transportation. It is clear from the table that most Arab states undergo road safety audits on new road construction projects and perform regular inspection on existing road infrastructure. Furthermore, all regional countries have already adopted national road safety strategies, as well as put in place various road safety policies, such as: speed limits, alcohol limits, motorcycle helmet requirements, seat belt regulations, and laws against using mobile phones while driving.

Despite the presence of such policies, many of these laws remain ineffective throughout most of the region, with the exception of Algeria and the GCC countries. Enforcing such regulations is an essential factor in reducing the overall road traffic mortality rate. These policies are vital, as the Arab region witnessed one of the highest road traffic deaths per 100,000 people in 2015, at an average of 24 deaths/100,000 people. Libya has the highest rate of road accident deaths in the world at 73.4 death/100,000 people in 2015. These values remain substantially high when compared to a European (EU-28) average of 6.4 deaths/100,000 people in 2015, indicating that regional road quality remains a major problem and points to inefficiency in government enforcement of existing safety laws.

The further development and investment in public transportation provides a good solution to reduce the road traffic mortality rate, the amount of congestion and traffic in major cities, as well as reduce the volume of air pollution from the transportation sector. As Table 23 and Table 25 indicate, the majority of regional countries are expanding their public transportation infrastructure and have put in place policies to encourage investment in public transportation. Nonetheless, the region still lacks efficient policies to promote walking or cycling, which are considered common modes of transportation, especially for short distances in Europe. A survey performed on seven European countries indicated that between 12 - 30% of all trips were made by walking, while 3- 28% of trips were made by bicycles (European Commission, 2017).

Table 23: Arab state's policies to assure the quality of road infrastructure and promote the use of public transportation

Country	Formal Audits Required for New Road Construction Projects	Regular Inspections of Existing Road Infrastructure	Policies to Promote Walking or Cycling	Policies to Encourage Investment in Public Transport
Algeria	Yes	Yes	No	Yes
Bahrain	Yes	Yes	No	Yes
Djibouti	No	No	No	No
Egypt	Yes	Yes	No	No
Iraq	Yes	No	Yes	Yes
Jordan	Yes	Yes	No	Yes
Kuwait	Yes	Yes	No	Yes
Lebanon	Yes	Yes	No	No
Libya	Yes	-	No	Yes
Mauritania	Yes	Yes	No	Yes
Morocco	Yes	Yes	Yes	Yes
Oman	Yes	Yes	Subnational	Yes
Palestine	-	-	-	-
Qatar	Yes	Yes	Yes	Yes
Saudi Arabia	Yes	Yes	Subnational	Yes
Sudan	Yes	Yes	Subnational	Subnational
Syria	-	-	-	-
Tunisia	No	No	No	Yes
United Arab Emirates	Yes	Yes	Subnational	Yes
Yemen	Yes	Yes	No	Yes

Source: World Health Organization's (WHO) global status report

In order to maintain road infrastructure, almost every country in the region requires formal audits for new road construction projects, as seen in Table 24. Most regional countries have further regulations that require regular inspection of existing road infrastructure. Likewise, almost all regional countries have some form of investment in public transport. However, only Iraq, Morocco, and Qatar have policies that promote walking or cycling.

Table 24: Public Transport System and Current Infrastructures

Country	Metro (km)	Tram (km)	Buses (per million population)	Taxi (per million population)	National Railway (km)
Algiers (Algeria)	13.5	23.2	587.4	1817.8	4500
Manama (Bahrain)	-	-	895.4	5715.2	-
Cairo (Egypt)	75.6	-	165.1	3573.3 (total in Egypt)	5153
Amman (Jordan)	-	-	181	3889	507
Kuwait City (Kuwait)	-	-	860.7	-	-
Rabat (Morocco)	-	16.7	270 (2010)	1900 (2010)	2109
Casablanca (Morocco)	-	31	214 (2010)	3496.3 (2010)	
Muscat (Oman)	-	-	448	26146.7*	-
Doha (Qatar)	-	-	3283	3659.3	
Riyadh (Saudi Arabia)			0	-	2400
Grand Tunis (Tunisia)	45.2	45.2	472	5752.9	2165
Abu Dhabi (United Arab Emirates)	-	-	234	4664.7	264
Dubai (United Arab Emirates)	74.6	10.6	620	2046	
Mauritania	-	-	-	-	704
Syria	-	-	-		2139
Sudan	-	-	-		4725
Iraq	-	-	-		2138

* Including private taxi, microbuses, and airport taxi

Mass transit systems, both road and rail, are the most energy efficient methods of transportation. When comparing, for example, the impact of a standard 45-seat bus versus a car with 1.5 passengers, even the bus with only six passengers occupies less road space per person and utilizes less fuel per person (Vasconcellos, 2011). Increasing mass public transit in the Arab region would, therefore, reduce road traffic, reduce fuel emissions, and provide cost and energy efficient transit.

Regional states should create a policy that makes private vehicles less attractive, including the implementation of fuel price increase, congestion fees, and toll charges in order to promote mass transit systems. Also Arab states should develop bike lanes for the people who would rather ride bicycles than drive, especially for relatively short distances. These policies, however, can tend to be regressive and can disproportionately affect the poor; rather, a policy to increase public transportation should also meet the needs of the poor through establishing secure and consistent funding, and expanding transport lines so that they meet residents' commuting needs.

Most large cities in the Arab region do not have public metro or tram transportation, leaving many reliant on buses, cars, and other fuel intensive methods of transport. The only regional cities with metros and trams are: Algiers (Algeria), Cairo (Egypt), Rabat (Morocco), Casablanca (Morocco), Tunis (Tunisia), Abu Dhabi (UAE), and Dubai (UAE). The implementation of mass public transport is a key sector where Arab states can improve.

Table 25: Programs to improve public transport in Arab region transportation

Country	Projects	Status
Algeria	A 4km extension (Extension B) for Line 1, from Haï El Badr to El Harrach-Centre, was launched in October 2012. The Extension B entered into service in July 2015 and two more new extensions of Line 1 are scheduled to be completed by 2017. (Technology, N/A)	On going
	Algiers Metro, Algiers Commuter Train, Sidi Bel Abbes Tramway, Ouargla Tramway, Setif Tramway, Mostagantem Tramway	
	Batna Tramway, Oran Tramway, Annaba Tramway, Constantine Tramway, Global Rail Network	Planned
Bahrain	GCC Railway	On going
Djibouti	Non-Existent	
Egypt	Greater Cairo Metro – Line 3:	On going
	Phase 1: Included an additional five stations between Attaba and Abassia, and was completed February 2012	Completed
	Stage 2: Included an additional four stations between Fair Zone and Al Aharam street in Heliopolis, and was completed in May 2014	
	Stage 3: Contains 3 different lines including an additional 16 stations (Attaba – Kitkat), (Kitkat – Road El Farag) and (Kitkat - Cairo University). Under development	On going
	Stage 4: Includes 8 stations and expansions from Al Ahram in Heliopolis to Cairo Airport. Future project	
	Line 4: Will include 17 stations and will expand between Remaya square up to El-Malek El-Saleh station of Line 1 and will meet Line 2 in Giza station for the service exchange between the two lines	Planned
	700 buses are expected to enter the public transportation service in Cairo in 2016	
	Cairo Monorail, Egypt National Railways, Suez Canal Rail Tunnels	
Iraq	Not existent	
Jordan	Amman Bus Rapid Transit (BRT) Phase 2, to include 3 routes with a total 20km and expected to become operational in 2018	On going
	Jordan National Cargo Railway Network, Queen Alia Light Rail Project, Shidya Mine Junction Rail	Planned
Kuwait	Kuwait Metropolitan Rapid Transit System (171km) Kuwait National Rail Road Network (574km double track total length)	On going
Lebanon	Greater Beirut Urban Transport Project	Planned
Libya	Non-existent	
Mauritania	-	
Morocco	Casablanca Tramway, Multiple Rail Expansions, Rabat Metro, Bus à Haut Niveau de service in Marrakech and Agadir (BHNS).	On going
Oman	Oman Rail Project (2135km)	Planned
	Al Batinah Expressway project: 265 kilometers, which will link Muscat, to the new Sohar Port and industrial, as well as the UAE border	
Palestine	None-existent	
Qatar	GCC railway	On going
	Doha Metro: The metro system will be built in two phases: the first phase, which is expected to become operational in 2020 and will include construction of three out of the four lines and 37 stations. The second phase, which will be operational in 2026, will involve the expansion of the phase one lines and the construction of an additional line, as well as an additional 72 stations.	
	Lusail Light Rail Transit Project: The 38.5 km project in the city of Lusail will include 4 lines, 25 stations, 7 underground stations and 1 depot and operation, maintenance and storage facility, and a test track	
	Long Distance Passenger Network: The long distance passenger and freight rail network will cover a distance of 350 kilometers, will be executed over four phases, and was planned to be initiated in 2015 and completed in 2030. The network is planned to include lines to Saudi Arabia, Bahrain, the new port, and Hamad International Airport outside of Doha.	Planned
	Doha West Bay Automated People Mover Project: The project is part of the Qatar Rail Project program. Phase 1 will have a capacity of 5,900 passengers per hour per direction and will include 5 kilometers of dual-track underground tunnel, 10 stations,and a fleet of 42 cars.	

Country	Projects	Status
Saudi Arabia	GCC railway expansion, Riyadh Public Transport Project	On going
	Haramain High Speed Rail connecting the holy cities of Makkah and Madinah via Jeddah and will include the construction of a 950 km line between Riyadh and Jeddah and a 115 km line between Dammam and Jubail, as well as the upgrade of the existing rail link between Riyadh and Dammam, including connections to the new Riyadh-Jeddah and Dammam-Jubail lines	
	Land Bridge Rail Network connecting the Red Sea to the Arabian Gulf and will involve the construction of a 950 km line between Riyadh and Jeddah, a 115 km line between Dammam and Jubail. as well as the upgrade of the existing rail link between Riyadh and Dammam, including connection to the new Riyadh-Jeddah and Dammam-Jubail lines	
	Jeddah Rail Transit, Makkah Rail Transit, Dammam Rail Transit, Madina Rail Transit	
Sudan	-	
Syria	-	
Tunisia	Rail Expansion, Bus and Train Upgrade Sfax public transport project, 2nd phase of Tunis Rapid Rail Network	On going
		Planned
United Arab Emirates	GCC Railway, Abu Dhabi Metro and Light-Rail, and dedicated bus lanes (Dubai)	On going
	Etihad Rail is a 1,200 km network that will be extended across the United Arab Emirates and will be completed through 3 stages: - Stage 1 of the rail network (commenced in December 2015) links Shah and Habshan to the port of Ruwais (264 km) - Stage 2 will connect the railway to Mussafah, to the Gulf ports of Khalifa and Jebel Ali, and to the Saudi and Omani borders (628 km) - Stage 3 will extend the network from Dubai to the northern regions of Fujairah, Ras Al Khaimah, and Sharjah (279 km)	Planned
Yemen	-	

Cairo has one of the region's most extensive metro systems and it is currently undergoing expansion to increase route coverage, which will allow more passengers to take the metro. The first two phases of its expansion program have been completed, with the installation of nine new metro stations. In its next phase of development, the Cairo Metro will open a new line – its fourth line, as well as 41 new stations. These expansion plans will make the metro more accessible to the city's growing population that occupies an increasingly expanding urban space.

Other regional countries have made plans to build metros in urban areas. Qatar is one such example, with a current plan to build a metro in Doha. The first phase will see the construction of three out of the four planned lines with 37 stations, which is expected to be completed in 2020. The second phase, to be completed in 2026, will expand the phase one lines and add an additional line with 72 new stations.

The GCC Railway Project is the largest railway project in the GCC, connecting all six GCC countries with 2,177 km of railway. The project is estimated to cost between $200-250 billion US$ and is owned by the government of Bahrain, the government of Kuwait, Etihad Rail, Oman Rail, Qatar Rail, and Saudi Railway Company. Although the execution of the project was initially expected to be completed by 2018, the project deadline has been pushed back by three years, due to the plunges in oil prices, and is now expected to be completed by 2021.

Table 26: GCC National Railway Length (km)

Country	National Railway Length (km)
Kuwait	145
Bahrain	36
Qatar	283
Oman	306
United Arab Emirates	684
Saudi Arabia	663
Total	**2,117**

3.3. Financial Incentives

The success of energy efficiency measures hinges on consistent, reliable, and adequate financial support. The lack of such financing remains one of the biggest hurdles in implementing national programs to reduce energy consumption in the Arab region. High initial start-up costs for some EE measures (for example, thermal insulation retrofitting), combined with the lack of investor awareness of the financial benefits of energy savings, and fear of hidden costs can hinder financing. The lack of adequate financing is further hindered in the Arab region by heavily subsidized energy costs. Such factors prevent residents, businesses, and the public sector in the Arab region from participating in long-term and cost-saving EE measures.

3.3.1. EE Funds

Eight regional countries have funds earmarked, or are in the process of establishing funds, for investing and administering subsidy schemes for EE initiatives. The presence of EE funds, however, does not always directly ensure financing of EE projects. Nevertheless, such funds are a step forward in shifting fuel subsidies into EE incentives, mobilizing current funds and making financing more efficient. Table 27 illustrates regional EE funds, sources of financing, and their disbursement procedures.

Several regional states have dedicated funding for EE efforts. The most common funding mechanisms are credit lines that are generally funded by international financing agencies, with matched state contributions. These funds, in countries like Egypt, Lebanon, Algeria, the UAE, and Morocco, fund initiatives that aim to promote energy-saving and renewable energy technologies, raise awareness in this area, reduce operating costs, and encourage competitiveness. In such schemes, some Arab states obtain funding from energy taxes, for example, in Algeria.

Table 27: Status of EE Funds

Country	EE Fund	Source of Financing	Disbursement Procedure
Algeria	• Conservation (FNME) with annual capital of €57 million	As per the Finance Law of 2000: • Taxes on natural gas (AD 0.0015/ btu) and electricity (AD 0.02/kWh) • Initial government contribution of AD 100 million (€1.15 million)	The inter-ministerial order of September 17, 2000 defines six areas of expenditure, including: • Granting credits for activities selected through competitive proposals • Loans at zero or reduced rates • Guarantees for loans from third parties to facilitate access to credit
	• EU fund of €40 million to support Algeria diversify its economy and improve business climate, €10 million of which is earmarked for RE and EE projects.	EU	EU-Algeria: EU adopts €40 million projects on March 13, 2017. The high level EU-Algeria Association Council, which took place in Brussels, signed a €40 million package between the EU and Algeria to support Algeria diversify its economy and improve business climate through three specific programs: • Support programme for the development of renewable energy and promotion of energy efficiency in Algeria' (€10 million) • Reform of public finances (€10) • Support programme for the implementation of the Association Agreement (€20 million)
Djibouti	• The Japanese government has recently established a grant to install solar panels at the Djibouti Centre for Research and Studies.	Japan	-
	• Funds to enable the Djibouti Energy Management Agency (ADME) to study energy consumption of 10 buildings.	UNDP	
	• ADME project to reduce energy consumption in public buildings.	Republic of Djibouti	
Egypt	• Green Environment Financing Facility (GEFF) with a €140 million investment	• European Bank for Reconstruction and Development (EBRD) • Agence Française de Développement (AFD) • European Investment Bank (EIB).	The fund includes: • Grants loans of up to $5 million to private entrepreneurs and enterprises . • Low-interest loans with five-year flexible payment plans. • Investment incentive grants of 10%-15% of the value of the loan.

Country	EE Fund	Source of Financing	Disbursement Procedure
Jordan	• Jordanian Renewable Energy and Energy Efficiency Fund (JREEEF) established by Law on Renewable Energy and Energy Efficiency (2012)	• Annual budget allocations • Return on investment from the Fund's own investment	• Different programs using different funds and delivery mechanisms targeting SWH, LEDs, PV roofs….
	• Second Programmatic Energy and Water Sector Reforms DPL - $250 Million loan for a policy program that aims to (i) improve the financial viability of the electricity and water sectors, and (ii) increase efficiency gains in the energy and water sectors	• World Bank	
Lebanon	National Energy Efficiency and Renewable Energy Action (NEEREA)	• Central Bank of Lebanon (BDL)	• Low-interest loans (between 0 - 1%) for RE and EE projects with a repayment period of 14 years with a grace period of 2 years for new projects and a repayment period of 10 years with a 2 years grace period for existing projects. Loans can be as low as US$ 2,000 and as high as US$ 20 million.
		• 15 million EUR from an EU grant for RE projects (2011 - 2014)	• 15% of the green loan amount for non-subsidized sectors and 5% for subsidized sectors with a ceiling not exceeding US$ 750,000 of grant money.
	Lebanon Energy Efficiency Global Loan. Project ID: NIF-South-29	European Commission	
Morocco	Energy Development Fund (EDF) with a total capital of one billion $US	• 200 million from Hassan II fund • 300 million from UAE • 500 million from Saudi Arabia	-
Palestine	Revolving Fund for EE projects established in 2012	• Start-up capital from donor institutions • Funds saved through EE projects	• Free energy audits for public institutions/ facilities
Syria	Fund for residential solar water heaters	Fund provided by the Ministry of Electricity	• The fund covers 50% of the price with the solar water heater system's price not exceeding 20,000 Syrian Liras.
Tunisia	National Fund for Energy Management (FNME) established by Law 2005-82 (2005) and Law 2005- 106 (2005)	• Revenues from taxes on the first registration of cars and import or manufacturing of air conditioners, according to the Law No 2005-2234 (2005)	• Financial incentives for EE projects in the industrial sector through "contract program"
		• financial savings achieved as a result of EE activities	• 50% of the total investment cost of EE demonstration projects, with a ceiling of TND 100,000
		• Private donations	• Incentives to promote the development of solar water heaters market
	Tunisia - Energy Efficiency 2010 and Biomass Project		
UAE	Dubai Green Fund with AED 100 billion	Founding investors from Dubai, with additional investment from the private sector, international banks and large investment companies	

Algeria

The funds in the National Fund for Energy Conservation (FNME) are mainly used to finance activities of the Algerian EE agency, L'Agence Nationale pour la Promotion et la Rationalisation de l'Utilisation de l'Energie (APRUE). In 2014, the National Fund for Energy Conservation (FNME) was merged with the National Fund for Renewable Energy and Co-generation (FNERC) to form the National Fund for Energy Management and Renewable Energy and Co-generation (FNMEERC).

The FNMEERC is divided into two different lines of financing. The first dedicated to renewable energy while the second is dedicated to energy management. The latter aims at financing the initiatives and measures under the National Programme for Energy Efficiency through grants for unpaid loans or guarantees for loans or pre-financing.

Currently, the energy conservation fund focuses on financing five EE programs administered by APRUE:

The "Eco-Lumiere Program" aims to promote EE lighting through distribution of one million CFLs accompanied by information and raising awareness campaigns. The CFLs are distributed to the public at half retail price; the remaining 50% of the price is covered by the FNME.

The "Eco-Bat Program" aims to promote EE in the construction sector, which includes various activities, from mobilizing key stakeholders around the issue of EE in the construction sector, to building 600 EE demonstration projects in different climatic zones of Algeria. The funds in the FNME are mainly used to subsidize 80% of the additional cost of constructing these EE buildings beyond the cost of a conventional building. Additionally, the FNME finances any complementary research and studies in this field.

The "Al-Sol Program" aims to promote solar water heaters by providing subsidies to cover 45% of SWH cost capped at DZD 110,000. The first phase of the program includes distributing 400 residential system with a 200 liter storage tank. The second phase of the program will include distribution of 2,000 residential systems and 3,000 m2 of commercial solar water heating systems. The conditions for the residential sector will stay the same: 45% subsidy of the investment costs capped at a maximum of DZD 110,000. Commercial installations for hotels or restaurants will be subsidized up to 55%, capped at 35,000 DZD/m2 (Epp, 2011).

The "Pop-Air Program" aims to incentivize fuel-switching in cars from diesel to LPGs. The program provides special funding mechanism in cooperation with the Local Development Bank to incentivize conversion of vehicles to liquefied petroleum gas (LPGs).

Finally, the "Top-Industrie Program" aims to promote EE in the industrial sector mainly through identifying EE savings opportunities in the industrial sector, helping industries to reduce production costs and improve competitiveness, and support the development of market of energy service companies (ESCOs). The FNME finances 70% of the cost of conducting EE audit or feasibility study with a ceiling of DZD 700,000, as well as a direct subsidy on investment (20% for electric projects, 30% for thermal energy projects, and 10% for small cogeneration).

Djibouti

Djibouti has received grants from foreign governments and international bodies to develop EE initiatives (INDC 2015). The Japanese government, for example, funds a project to install solar panels at the Djibouti Centre for Research and Studies, the state's scientific institution. Additionally, the UNDP funds a two-year project to enable the Djibouti Energy Management Agency (ADME) to study energy consumption in 10 buildings. This project will be used as a capacity-building tool for understanding and better-implementing EE measures.

Additionally, the state has earmarked money for EE projects. For example, ADME has embarked on a two-year project to improve the energy efficiency of the old Cité Ministérielle building before the installation of a photovoltaic solar park on the roof of the building. In an effort to reduce the state's energy bill, ADME plans extend the project to all public buildings in the future.

Egypt

The funding for EE initiatives in Egypt has come from two programs. The first stage of funding came from Egypt Sustainable Energy Financing Facility (EgyptSEFF). EgyptSEFF had a $30 million US$ loan from the European Bank for Reconstruction and Development (EBRD) that was managed by the National Bank of Egypt. Under this program, EgyptSEFF provided credit lines for EE and RE projects in Egypt. The second phase of the program saw the founding of Green Environment Financing Facility (GEFF), with an increase in investment to 140 million Euros. In this second phase, EBRD was joined in a cooperation with Agence Française de Développement (AFD) and the European Investment Bank (EIB). The Egyptian managing partners for the second phase are the NBK bank and the QNB Alahli bank.

In both phases of the program, loans are available to private entrepreneurs and enterprises for amounts up to 5 million US$. Loans are low-interest and have five-year flexible payment plans. Additionally, the funds provide investment incentive grants of 10%-15% of the value of the loan.

Jordan

Jordan launched The Jordan Renewable Energy and Energy Efficiency Fund (JREEEF) in 2012 under the Ministry of Energy and Mineral Resources, however, the fund was not in operation until 2015. Before 2015, the World Bank's Energy Efficiency Investment Support Framework Project for Jordan provided financing to incentivize EE and RE investments that effectively made the JREEEF operational.

Morocco

Morocco has established significant funds to meet their 2020 RE and EE goals through a combination of state funds, investment financing, and international donors. Presently, Morocco has a $ 1 billion Energy Development Fund, comprised of donations by Saudi Arabia ($ 500 million), the United Arab Emirates ($ 300 million) and the Hassan II Fund for Economic and Social Development ($ 200 million). A portion of this fund is earmarked for the Société d'Investissements Énergétiques (SIE) - the state's main RE and EE financial arm with a 1 billion DH capital to act as a private state investor in developing RE and EE projects. The SIE, created in 2009, facilitates investments in public and private RE and EE initiatives. Most of the SIE funds, however, are invested in RE projects, with EE initiatives receiving a quarter of the fund.

International financing has also been made available for RE and EE projects in Morocco through Morocco Sustainable Energy Financing Facility (MorSEFF), which is credit line with a €110 million capital reserved for Moroccan private companies. It is funded by the European Bank for Reconstruction and Development (EBRD), in partnership with the French Development Agency (AFD), the European Investment Bank (EIB), and the Kreditanstalt für Wiederaufbau (KfW). Like most regional credit lines, MorSEFF provides technical assistance and investment incentives, along with financing for EE and RE initiatives. Financing includes loans of up to 3 million DH for small-scale projects and 50 million DH for larger companies. Up to 10% of the loan value can be obtained as a grant from the EU Neighbourhood Investment Facility (EU NIF). For these projects, all funds are distributed through Moroccan banks.

Palestine

The Revolving Fund in Palestine was established in 2012 with the AFD providing start-up capital in two phases: $250,000 for the first phase and $1.5 million for the second phase in 2014. The fund invests in public sector EE measures and money saved from EE measures is further reverted back into the fund. Several EE measures have been implanted through the Revolving Fund, including EE efficient building projects and projects that install solar water heaters.

Tunisia

The National Fund for Energy Conservation (FNME) changed in 2014 to the Energy Transition Fund (FTE) is one of the oldest funds in the region. The mandate of FNME includes financing renewable energy, energy efficiency and fuel substitution initiatives. Currently, the following EE programs are financed through FNME:

The "Contract Program" aims to promote industrial EE though signing voluntary bilateral agreements with large industrial facilities on achieving certain EE targets. Companies undergo energy audits, upon which ANME and promoters sign a contract with an industrial facility to realize number of energy-saving actions. To assist in achieving EE targets, the following support schemes are available for the industrial EE projects:[4]

- 70% of energy audit costs with a ceiling of TND 30,000
- 70% of immaterial investments with a ceiling of TND 70,000
- 20% of material investments with a ceiling of TND 100,000 for facilities whose annual total average energy consumption does not exceed 4,000 toe; TND 200,000 for facilities whose annual total average energy consumption runs from 4,000 to 7,000 toe; TND 250,000 for facilities whose annual total average energy consumption exceeds 7,000 toe.

Buildings: FNME provides 50% of the total investment cost of EE demonstration projects, with a ceiling of TND 100,000.

The "PROSOL tertiary" program, jointly developed and co-financed by ANME and the UN Environment Programme (UNEP), aims to support the development of solar water heater market in the service or commercial sector. The FNME covers the following components of the support schemes provided through the "PROSOL tertiary" program:

- 70% of the energy audit cost with a ceiling of TND 70,000
- 30% of the total investment cost with a ceiling of TND 150 per square meter

"PROSOL industriel" aims to support the development of solar thermal market for industrial applications. The FNME provides 30% of the total investment cost, with a ceiling of TND 150 per square meter.

Fishery sector: 40% of the total investment cost, with a ceiling of TND 30,000.

Other financial incentives include subsidies for co-generation (20% of the total investment cost, with a ceiling of TND 500,000); and for substitution of natural gas (20% of the total investment cost, with a ceiling of TND 500,000).

Between 2008 and 2011, the FNME spent TND 260 million, up from TND 59 million between 2005 and 2009. FNME has been recently transformed into Energy Transition Fund.

UAE

The UAE established a credit line for EE and RE measures in 2017, called the Dubai Green Fund. The AED 100 billion fund is provided by Dubai investors, the private sector, international banks, and investment companies. The fund will provide both short and long term loans with low-interest rates for EE projects.

3.3.2. Fiscal Incentives

Fiscal incentives include tax credits, tax reductions, tax exemptions, and other preferential treatment in taxation. Such incentives can encourage EE investments through reducing the overall costs of EE projects. Fiscal incentives are a more effective incentivizing mechanism for EE in countries where taxes and the tax collection rates are high. While many countries across the world have adopted fiscal incentives for EE investments, few countries in the MENA region offer tax incentives for such investments. The following table provides an overview of the tax scheme for selected EE initiatives.

Table 24: Taxes and Duties

Financial Incentives	Customs Duty (%)			VAT/ Sales Tax (%)	Tax Incentives
	CFLs	LED Bulbs	SWH		
Algeria	30	5	5	17	Under the draft law, all imported goods and services intended for investment projects will be ex-empted from customs duties and value-added tax (VAT).
Bahrain	5	5	5	None	None
Egypt	30	5	5	Sales Tax 13%/ VAT 14%	Exemption from customs duties for EE equipment
Iraq	15	15	15	None	None
Jordan	20	20	20	16	Exemption from sales tax and customs duties for EE equipment
Kuwait	5	0	5	None	None
Lebanon	15	15	5	10	None
Libya	5	-	5	None	None
Morocco	2.5	2.5	2.5	20	None
Palestine	8	0	0	18	Exemption from VAT/sales tax
Qatar	5	0	5	None	None
Saudi Arabia	5	[R1]0	5	None	None
Sudan	20	10	20	10	None
Syria	5	1	30	No data	N/A
Tunisia	15	30	27	18	Exemption from VAT tax and reduction of customs duty to 10% for EE equipment
					To 10% for EE equipment
UAE	5	5	5	None	None
Yemen	5	5	5	5	None
Mauritania	-	-	-	14	
Djibouti	-	-	-	33	

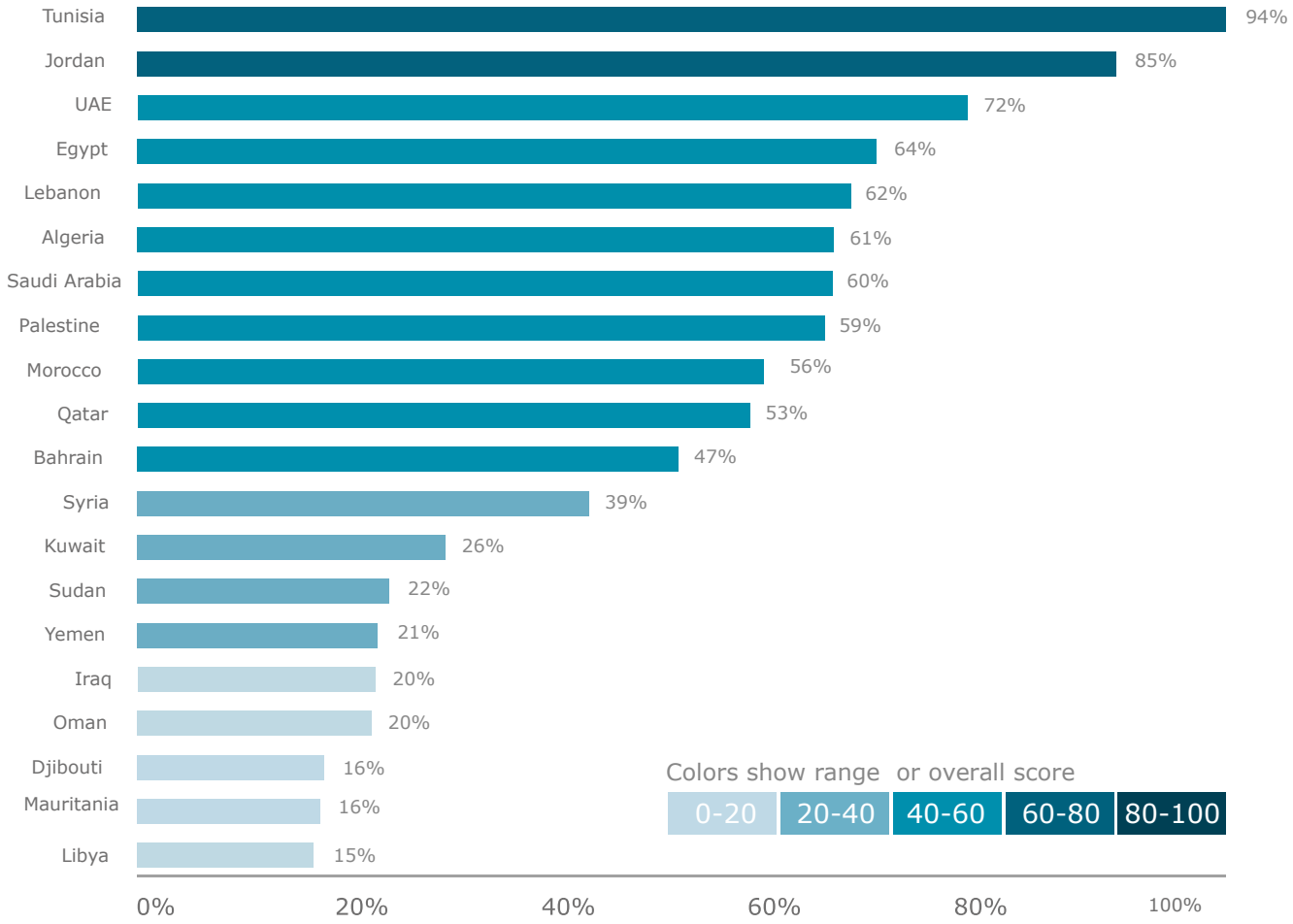
Sources: Duty Calculator, 2016; Trading Economics, 2016a; Trading Economics, 2016b; PKF, 2011; PKF, 2013; Trading Economics, 2014c; Deloitte, 2014

3.4. Policy Framework Final Scores and Ranking

Figure 16 shows the final scores for the policy framework category, with Tunisia, Jordan, the UAE, Egypt, and Lebanon taking the top scores. Regionally, the wide spread application of long term EE strategies is an important step forward in enabling energy efficiency. 15 out of 20 Arab countries have adopted long-term strategies in the form of a master plan, program, or country development vision for the effective use of energy. Many of these strategies are multifaceted and include: financial incentives for EE lighting and solar water heaters, regulations on high-energy consuming appliances and lighting, price incentives and regulations to cut down peak-time electricity use, and regulations to promote EE buildings. NEEAPs provide comprehensive plans to reduce energy consumption; several countries have completed their first NEEAP and are preparing their second plan, including: Egypt, Jordan, and Palestine. Lebanon has completed its first NEEAP and in 2016 adopted its second NEEAP (2015 – 2017). Also, countries like Bahrain have made great progress by adopting its first NEEAP in 2016. Despite this progress, many counties need to improve the enforcement of their EE policies. Regional EE policy has been particularly effective in phasing out inefficient lighting, which reflects significant progress considering that lighting is responsible for nearly 34% of electricity consumption in the Arab region. Several countries have banned the sale of incandescent lightbulbs, most notably Qatar through its Tarsheed Program. Likewise, numerous regional countries have made MEPS for appliances mandatory, ensuring that only energy efficient equipment can enter the market. Also, 13 regional countries have put forth EE building regulations, of which 11 countries' policies are mandatory.

Increasing EE in the transport sector is an area for improvement in the region. Only a few countries include transportation reforms in their national strategies, such as reduction of taxes and customs on hybrid cars and the promotion of public transport. Tunisia and Morocco are the only regional countries with long term EE goals in the transportation sector. Also, the majority of the Arab countries still lack any significant emission standards for vehicles. Other areas for improvement are industrial EE policies, as many regional countries still do not have comprehensive industrial EE policies. Only 7 Arab states have such policies, some of which are not fully enforced.

Figure 16: Policy Framework Final Scores



PROGRESS HIGHLIGHTS
POLICY FRAMEWORK

Egypt

Egypt has made considerable efforts to create policies that encourage EE in terms of legal frameworks, NEEAPs, and making funds available to carries out EE plans. With the adoption of the new electricity law (no. 87/2016), Egypt has made steps to create a legal framework for EE policy. Egypt further evaluated its first NEEAP and is currently preparing its second NEEAP. Also, the second phase of Egypt Sustainable Energy Financing Facility (EgyptSEFF) program, called Green Environment Financing Facility (GEFF), saw in increase in investment to 140 million Euros for credit lines reserved for EE and RE initiatives.

Jordan

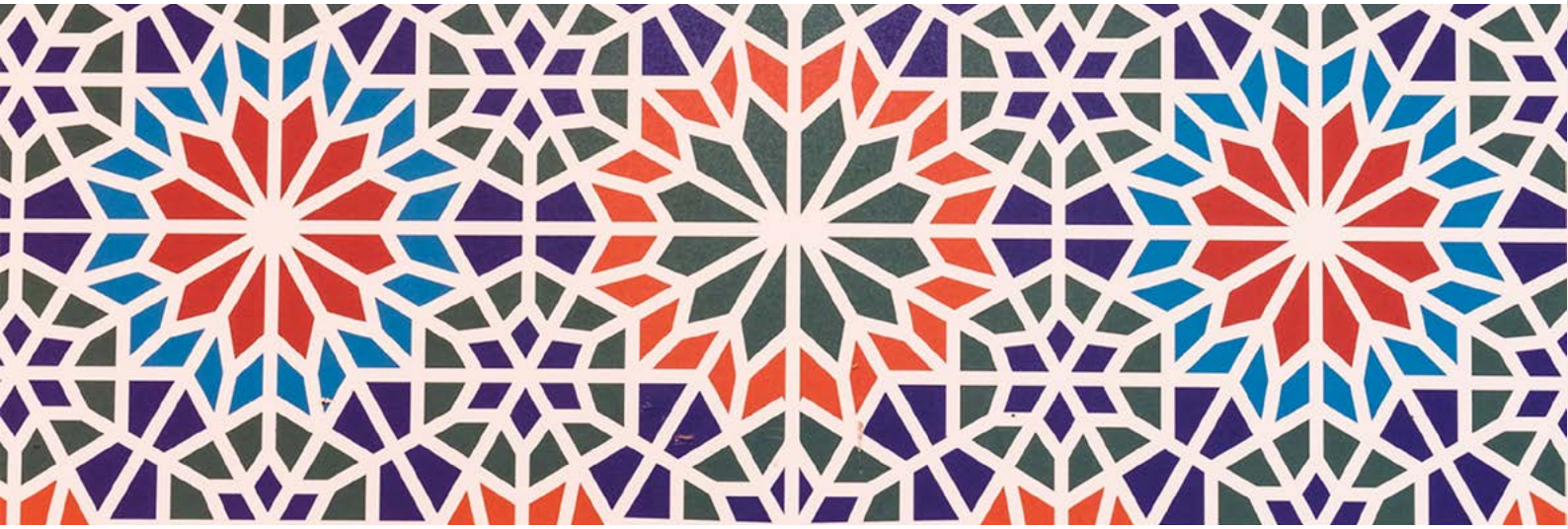
Jordan made key improvements in EE policy since 2015. Like several other regional countries, Jordan has evaluated its first NEEAP and is preparing its second national energy efficiency action plan. Several specific policies have increased EE in Jordan, including the phasing out of inefficient lighting as well as the exemption of energy efficiency equipment from custom duties and sales tax. In 2015, Jordan's Renewable Energy and Energy Efficiency Fund (JREEEF) became fully operational and has provided financing for EE and RE investments.

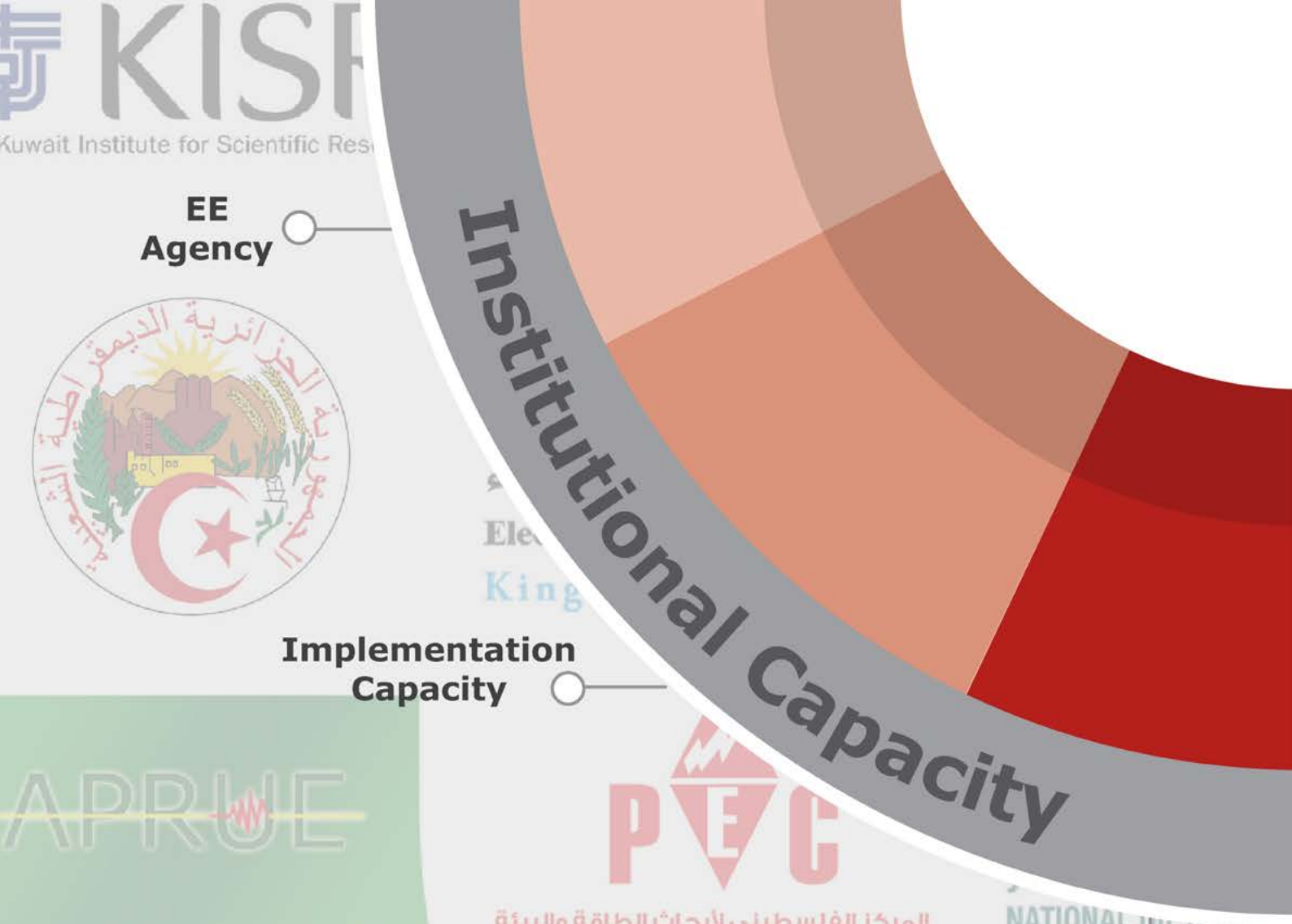
Lebanon

Lebanon evaluated its first NEEAP and instituted its second NEEAP "NEEAP 2016 – 2020," which requires an investment of 600 – 950 million US$ over the next five years to implement its plans. Through power sector and end-use measures, the plan hopes to reduce electric power growth rate from 7% to 5.8% by 2020 from its' current 7% annual growth rate to 5.8%. The implementation of the country's second NEEAP is an important opportunity to build on the lessons learned from Lebanon's first plan.

UAE

In 2017, the UAE established the Dubai Green Fund, with a AED 100 billion line of credit for EE projects. This fund will incentivize the expansion of EE efforts in the country.




Institutional Capacity
EE Agency
Implementation Capacity
Monitoring and Evaluation

4 Institutional Capacity

Institutional capacity assesses the ability of states to develop and successfully implement EE policies. There are three factors that describe a state's EE institutional capacity: (1) the presence of EE institutions, (2) institutional implementation capacity, and (3) institutional ability to monitor and evaluate EE initiatives. The third factor, however, is not assessed in the AFEX EE 2017, due to a lack of data. The indicators of EE institutions and their implementation capacity are provided in Table 29.

Table 29: Institutional Capacity Indicators

Category	Factors	Indicator	Score/Measuring Unit
Institutional Capacity	EE Institutions	Designated EE units within ministries	Presence of designated EE unit; adequacy of technical and human resources; capacity to formulate and monitor EE policies
		Designated EE agency	Presence of designated EE agency; adequacy of technical and human resources; capacity to implement EE policies
	Implementation Capacity	Number of EE buildings built	Percentage of new building stock built according to EE regulations
		Number of demonstration/pilot projects	Expert assessment from 0 to 10 based on number of demonstration projects; market size of construction industry
		Solar water heater diffusion rate	m^2 of panels per 1,000 inhabitants
		Corruption Perception Index	CPI scores

4.1. EE Governance and Institutions

Effective EE governance is the key to successfully implementing EE strategies, programs and policies. However, many barriers hamper the effective implementation of EE programs, including: problems related to financing EE initiatives, spreading information and promoting consumer and investor awareness of EE benefits, developing and implementing regulations to encourage EE, and the technical capacity to carry out EE initiatives (IEA, 2010). In order to successfully overcome such challenges, states need effective EE governance to develop and implement legislative frameworks, regulations, funding mechanisms, provide institutional oversight, as well as coordinate with the wide array of EE stakeholders to ensure a degree of accountability.

Institutional arrangements in the Arab region are often complex because most countries have a high degree of overlap and redundancy involved in EE governance, with numerous institutions involved in EE policies. This places even more importance on organizing bodies or mechanisms to ensure coordination between state institutions to effectively carry out government initiatives. Larger organizing bodies are vital in coordinating among the various stakeholders, including: government institutions, private sector, civil society, and donor agencies. The key institutions and stakeholders in EE policy in the Arab region are presented in Table 30.

Table 30: EE Institutional Arrangements

Algeria	Ministry	Electricity	Renewable Energy and Energy Conservation Directorate within Ministry of Energy and Mines	
		Oil and Gas		
		Others	-	
	Designated EE Agency		National Agency for the Promotion and Rationalization of Use of Energy (APRUE)	
	Independent Regulator		Commission de Régulation de l'Electricité et du Gaz (CREG)	
Bahrain	Ministry	Electricity	Electricity and Water Conservation Directorate at the Electricity and Water Authority; Sustainable Energy Unit at the Ministry of Electricity	
		Oil and Gas	National Oil and Gas Authority (NOGA)	
		Others	The High Energy Committee in charge of formulating energy policy	
	Designated EE Agency		-	
	Independent Regulator		-	
Djibouti	Ministry	Energy	Ministry of Energy and Natural Resources (No dedicated EE unit)	
		Others		
	Designated EE Agency		Djiboutian Agency for energy conservation (ADME)	
	Independent Regulator			
Egypt	Ministry	Electricity	Energy Efficiency and climate change unit at Ministry of Electricity and Renewable Energy	
		Oil and Gas	Ministry of Petroleum (No dedicated EE unit)	
		Others	EE Unit at the Council of Ministers Secretariat, EE Unit within the Ministry of Industry, and Green Tourism Unit within the Ministry of Tourism	
	Designated EE Agency			
	Independent Regulator		Egyptian Electric Utility and Consumer Protection Agency (EgyptERA)	
Iraq	Ministry	Electricity	Planning and Studies Office at the Ministry of Electricity	
		Oil and Gas	Ministry of Oil (No dedicated EE unit)	
		Others	-	
	Designated EE Agency		-	
	Independent Regulator		-	
Jordan	Ministry	Electricity	EE Department at the Ministry of Energy and Mineral Resources	
		Oil and Gas		
		Others	National Energy Research Center (NERC)	
	Designated EE Agency		-	
	Independent Regulator		Energy and Minerals Regulatory Commission	
Kuwait	Ministry	Electricity	Ministry of Electricity and Water (Energy Efficiency program managed by planning and training department)	
		Oil and Gas	Ministry of Oil (No dedicated EE unit)	
		Others	Kuwait Institute for Scientific Research (KISR)	
	Designated EE Agency		-	
	Independent Regulator		-	
Lebanon	Ministry	Electricity	Ministry of Energy and Water (No dedicated EE unit)	
		Oil and Gas	-	
		Others	Lebanese Center for Energy Conservation (LCEC)	
	Designated EE Agency		-	
	Independent Regulator		-	

Libya	Ministry	Electricity	Ministry of Electricity and Renewable Energy (No dedicated EE unit)	
		Oil and Gas	Ministry of Oil and Gas (No dedicated EE unit)	
		Others	-	
	Designated EE Agency		Renewable Energy Authority of Libya (REAOL)	
	Independent Regulator		-	
Mauritania	Ministry	Electricity	Ministry of Petroleum, Energy and Mining (Electricity and Power Control Department), Mauritania Electricity Company, Agency for Universal Public Access to Regulated Services	
		Oil and Gas		
		Others	-	
	Designated EE Agency		-	
	Independent Regulator		-	
Morocco	Ministry	Electricity	Renewable Energy and Energy Efficiency Department at the Ministry of Energy, Mines, Water and Environment	
		Oil and Gas	-	
		Others	-	
	Designated EE Agency		Moroccan Agency for Energy Efficiency (AMEE)	
	Independent Regulator		-	
Oman	Ministry	Electricity	Public Authority for Electricity and Water (No dedicated EE unit)	
		Oil and Gas	Minister of Oil and Gas (No dedicated EE unit)	
		Others	-	
	Designated EE Agency		-	
	Independent Regulator		Authority for Electricity Regulation (AER)	
Palestine	Ministry	Electricity	-	
		Oil and Gas		
		Others	-	
	Designated EE Agency		Palestinian Energy and Environment Research Centre (PEC) under the Palestinian Energy Authority (PEA)	
	Independent Regulator		Palestinian Electricity Regulatory Council (PERC)	
Qatar	Ministry	Electricity	Conservation and Energy Efficiency Department at the Qatar General Electricity and Water Corporation, KAHRAMAA	
		Oil and Gas	Ministry of Energy and Industry (No dedicated EE unit)	
		Others	Qatar Environment and Energy Research Institute, National Program for Conservation and Energy Efficiency "Tarsheed"	
	Designated EE Agency		-	
	Independent Regulator		Qatar's Education City, Qatar Science & Technology Park (QSTP) and Qatar Energy and Environment Research Institute (QEERI)	
Saudi Arabia	Ministry	Electricity	Energy Conservation and Awareness Department under the Ministry of Water and Electricity	
		Oil and Gas	Ministry of Petroleum and Mineral Resources (No dedicated EE unit)	
		Others	-	
	Designated EE Agency		Saudi Energy Efficiency Center (SEEC)	
	Independent Regulator		The Electricity and Co-generation Regulatory Authority (ECRA)	
Sudan	Ministry	Electricity	Directorate for Renewable and Alternative Energy within the Ministry of Electricity and Water	
		Oil and Gas	EE Department within Ministry of Oil	
		Others	-	
	Designated EE Agency		-	
	Independent Regulator		Electricity Regulatory Authority	

Syria	Ministry	Electricity	Ministry of Electricity (No dedicated EE Unit)	
		Oil and Gas	Ministry of Petroleum and Mineral Resources (No dedicated EE Unit)	
		Others	-	
	Designated EE Agency		National Energy Research Centre (NERC)	
	Independent Regulator		-	
Tunisia	Ministry	Electricity	General Directorate of Energy at the Ministry for Industry, Energy, and Mines	
		Oil and Gas		
		Others	-	
	Designated EE Agency		National Agency for Energy Conservation (ANME)	
	Independent Regulator		-	
UAE	Ministry	Electricity	Rationalization and Energy Usage Efficiency Department under Ministry of Energy	
		Oil and Gas		
		Others	Masdar Institute of Science and Technology	
	Designated EE Agency		Abu Dhabi Cooling Taskforce; Dubai Supreme Council of Energy	
	Independent Regulator		Regulation and Supervision Bureau (RSB)	
Yemen	Ministry	Electricity	Ministry of Electricity and Energy	
		Oil and Gas	Ministry of Oil and Minerals (No dedicated EE Unit)	
		Others	-	
	Designated EE Agency		-	
	Independent Regulator		-	

Dedicated EE Unit or Dedicated EE Agency

Dedicated EE Agency is under establishment or is not fully dedicated to EE

No Dedicated EE Unit or Dedicated EE Agency

Many regional countries have EE departments or units within a diversity of existing ministries. 10 out of 20 countries in the region have EE sections or departments within ministries associated with electricity, water, or energy, as can be seen in Table 26. Most energy exporting countries have separate ministries dedicated to the oil and gas sector and include: Algeria, Bahrain, Iraq, Egypt, Kuwait, Oman, Qatar, Saudi Arabia, UAE, Yemen, and Sudan. Most of these ministries focus on the operational side of the oil and gas sector and have departments or units dedicated to EE initiatives. Sudan is a notable exception, with an EE department in its Ministry of Oil. Egypt, on the other hand, has EE sections within the Ministry of Industry and the Ministry of Tourism and not in the ministries associated with the oil, gas, or energy sectors. The central challenge to effectively implementing EE initiatives in the region is that many Arab countries lack an integrated coordinated approach. This is particularly apparent in the sheer number of government and non-governmental institutions implementing EE programs, so that there are no coordinated efforts to overcome barriers to EE practices.

An institution or agency dedicated to EE allows for more efficient coordination in implementing initiatives and improves resource allocation, as they enable interaction across ministries and departments. 17 out of the 20 Arab countries presented in Table 26 have dedicated EE agencies or units that can provide some sort of cooperation between disparate institutions. These departments, however, tend to be scattered amongst different ministries and institutions, making it challenging to develop and enforce effective EE policy in the region. Several regional countries lack electricity regulatory bodies all together, including: Kuwait, Iraq, Lebanon, Libya, and Yemen. This makes the coordination of EE policies even less coherent.

Saudi Arabia's Center for Energy Efficiency

The Kingdom of Saudi Arabia has enacted an ambitious vision for change – Vision 2030 which among other things seeks to diversify its economy beyond oil exports. It also aims to reduce the energy intensity of growth in key sectors such as housing and buildings, consumer appliances, heavy industry, water, and transport. Local electricity consumption has been growing a fast pace in recent years and with most electricity generated from oil-burning power facilities, this acts as a drain of the Kingdom's oil export based revenues on which many of its development goals rest. Reducing the energy intensity of growth has thus emerged as a top priority from social, economic and environmental perspectives.

To achieve this goal Saudi Arabia launched a flagship National Energy Efficiency Programme (NEEP) in partnership with the United Nations Development Programme (UNDP), with a key focus on establishing the Saudi Energy Efficiency Center (SEEC) as a national hub to design new energy efficiency policies and action plans, forge new public-private partnerships, and scale up energy efficient technologies that reduce intensity of energy consumption while also reducing carbon footprints. This involves provision by the Government of over $36 million to the programme for technical assistance activities, making it one of UNDP's largest sustainable energy projects globally, along with a strong partnership with over a dozen key national Ministries from various sectors as well as large public companies in oil and water sectors. One initial focus in recent years has been to gradually improve the efficiency of air conditioning, which makes up the majority of electricity use in the Kingdom. SEEC will help replace 920,000 inefficient air-conditioning units with high efficiency models, reducing the burden on national energy reserves while also delivering hundreds of millions of US dollars in direct savings on household energy bills. This helps achieve a more sustainable energy trajectory locally in the Kingdom, and global goals under the new Paris Agreement on Climate Change and Sustainable Development Goal 7 on sustainable energy.

4.2. IMPLEMENTING CAPACITY

The effectiveness of EE initiatives and policies depend on successful implementation and compliance with EE regulations, which requires institutional authorities that can enforce regulations through clearly prescribed and transparent enforcement procedures (IEA, 2010). Effective implementation of EE policy is further supported by compliance-promotion efforts, such as capacity building programs, demonstration projects, and financial incentives. Challenges and successes in implanting regional EE initiatives are highlighted below in three sections: EE buildings, EE lighting initiatives, and solar heating.

4.2.1. EE Buildings

Many Arab states have adopted EE regulations for the rapidly growing construction industry in the region, yet these regulations are rarely enforced. There are many barriers to applying EE construction regulations, including: the lack of institutional coordination among different agencies or ministries, limited state and private investment in EE construction initiatives, and "low capacity for manufacturing or servicing EE products." (IEA 2013). Both investors and the construction industry at large need to be engaged in successful implementation of EE buildings, however, unclear regulations, lack of capacity for EE construction materials and technologies, and energy subsidies that distort market prices make such investments less attractive (IEA 2013).

Leadership in Energy and Environmental Design (LEED) certification, organized by the US Green Building Council (USGBC), is the most globally adopted third party certification in EE construction. LEED certifications reflect a comprehensive approach to EE and environmentally sustainable buildings that reduce energy use and water consumption. LEED certification can be applied to many different types of buildings, such as: building design and construction (BD + C) for new constructions (NC) and major renovations of older buildings, building maintenance and operations (O + M) for refurbishing older buildings with EE mechanisms. Likewise, the EE of an interior space can be improved with interior design and construction (ID + C) certification, houses can also receive certification (Homes) that reduces electricity bills, and certifications can apply to an entire neighborhood development (ND).

Table 31: Number of EE Buildings Based on LEED project data 2016

Country	Number of EE Buildings Based on LEED project data 2016				
	Certified	Registered	Total	Certified Homes	
Algeria	0	1	2	0	Based on LEED BD+C
Bahrain	1	19	20	0	Based on LEED
Djibouti	3	5	8	0	Based on LEED BD+C
Egypt	21	60	41	0	Based on LEED BD+C, LEED O+M, LEED ID+C
Iraq	0	2	2	0	Based on LEED BD+C
Jordan	4	18	22	0	Based on LEED BD+C, LEED ID+C
Kuwait	7	8	15	0	Based on LEED BD+C, LEED ID+C
Lebanon	11	49	60	0	Based on LEED BD+C, LEED O+M, LEED ID+C
Mauritania	0	1	1	0	-
Morocco	4	4	8	0	Based on LEED BD+C
Oman	5	27	32	0	Based on LEED BD+C
Palestine	0	1	1	0	Based on LEED BD+C
Qatar	17	61	78	0	Based on LEED BD+C, LEED O+M, LEED ID+C
Saudi Arabia	54	111	165	192	Based on LEED BD+C, LEED O+M, LEED ID+C
Sudan	1	0	1	0	Based on LEED BD+C
Syria	n/a	n/a	0	n/a	-
Tunisia	2	1	3	0	Based on LEED BD+C
UAE	167	622	789	762	Based on LEED BD+C, LEED O+M, LEED ID+C
Yemen	0	1	1	0	Based on LEED BD+C

Given that LEED certification is the most common baseline for determining EE buildings, it is used as an indicator of EE building practices in the region. LEED works on a point system; it takes 40 points to be certified as a LEED building. LEED registered buildings are constructions that have been registered and are awaiting evaluation. Table 31 presents the number of LEED certified and LEED registered buildings in the region; and it is apparent that LEED certified buildings are becoming more popular in the Arab region. Yet a majority of the countries in the region constructed less than 10 LEED certified buildings in 2016, with most countries only constructing one LEED building in 2016. Several regional countries (Qatar, Lebanon, Egypt, Saudi Arabia, and the UAE) have constructed more than 10 LEED certified buildings in 2016.

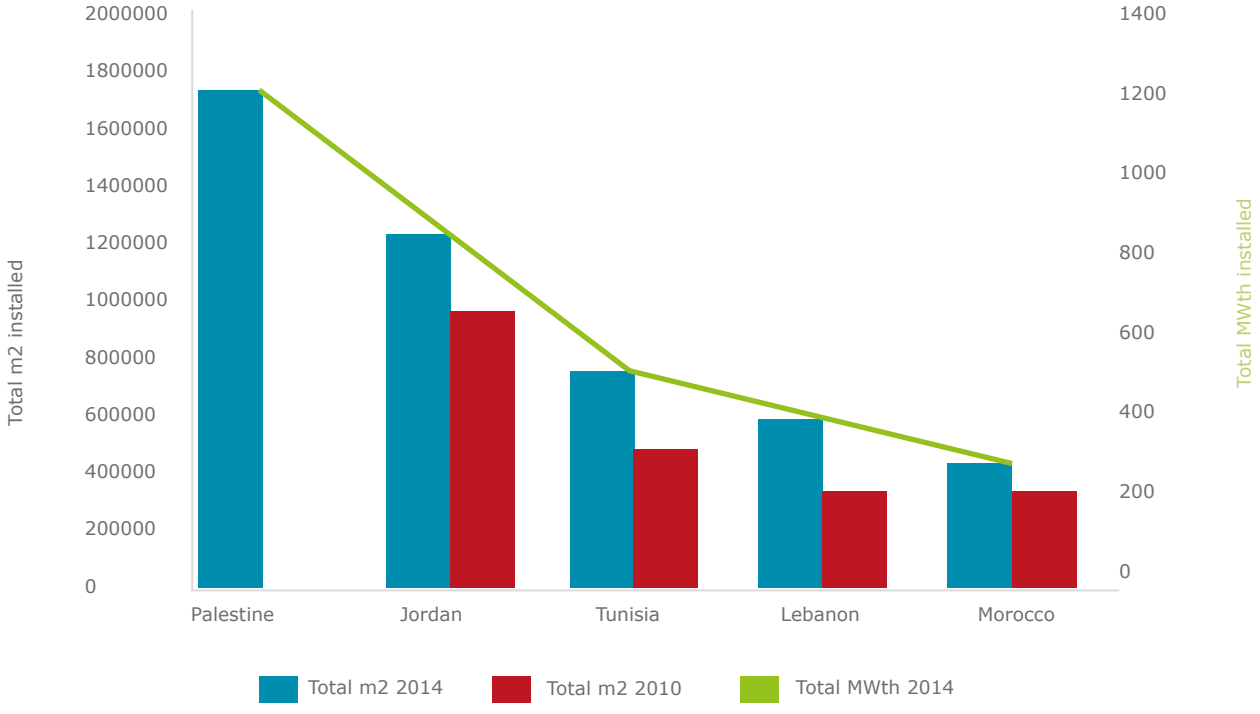
Increasing the number of LEED buildings in the region requires engagement with consumer demand through a combined approach of regulations, incentives, and public awareness of the benefits of LEED certified public, commercial, and residential buildings. If such measures are to succeed, professionals in the building sector - for example architects, designers, contractors, installers and others - need to develop skills and knowledge of LEED construction requirements and methods, as well as gain access to sustainable materials. Saudi Arabia and particularly the UAE have overcome some of these challenges and have made substantial efforts to build more LEED certified buildings. Outside the USA, the UAE has the 10th highest number of LEED certified constructions in the world, according to USGBC.

4.2.2. Diffusion of Solar Water Heaters

Solar water heaters can have a strong impact on EE by drastically reducing electricity consumption for both residential and commercial consumers, with minimal financial and infrastructure investment (UNEP 2015). Despite the region's location in the sun belt, solar water heaters are not as prevalent in part due to energy subsidies that makes it economically less attractive for residential and commercial consumers to make the initial investment in solar water heaters. The lack of quality control infrastructure in the Arab region is also problematic, as it allows for low quality products. Further, the lack of a certifying agency for solar water heater installers increases the possibility of incorrect installation. Despite these challenges, the number of solar water heaters in the Arab region has been increasing.

The solar water heater (SWH) market has grown significantly in both Lebanon and Tunisia, compared to 2010 levels (73% and 58%, respectively). Palestine remains the largest installer of solar water heaters in the Arab region, with a total thermal capacity of 1250 MWth at the end of 2014. The prevalence of SWHs in the Palestinian energy market is mainly due to high unsubsidized energy prices in the country, implemented as a means of reducing dependency on imported electricity. Figure 14 shows the total SWH installed capacity in five Arab countries, constituting the major portion of installed SWHs in the region. The total SWH installed capacity is shown both in square meters and MWth of thermal energy output.

Figure 17: Installed SWH capacity in the Arab region



As part of its national strategy to install 200,000 solar water heaters, the Jordanian Renewable Energy and Energy Efficiency Fund (JREEEF) is planning in 2017 to initiate a grant program covering 30% to 50% of the price of solar water heaters installed in households with a monthly electricity consumption of less than 600 kWh.

4.2.3. EE Lighting Initiatives

Incandescent bulbs are widely used in the Arab region, particularly in residential buildings, which leads to higher energy consumptions than if more efficient bulbs were used. Numerous countries, however, have enacted policies, programs, and partnered with intergovernmental organizations to promote the use of EE lighting. Most initiatives focus on installing EE lights (either CFL or LED) through governmental regulations, replacement and distribution programs, and public awareness campaigns. Table 28 presents regional countries' initiatives to reduce dependence on inefficient lighting. These efforts, in part, have seen an increase in the use of energy efficient lighting in the region. Ultimately, the price of CFL and LED lights have dropped in most Arab countries, making EE lighting more affordable and attractive.

The most common approach for implementing EE lighting in the region is through programs that replace incandescent bulbs with EE lighting. As table 28 shows, such programs are in operation in almost every regional country. There are several schemes to distribute EE lights in both residential and non-residential sectors in Algeria, Egypt, Djibouti, Jordan, Lebanon, Morocco, Palestine, and Tunisia. Some countries, such as Iraq, have implemented programs to replace incandescent lights in government buildings. Replacing inefficient street lights requires upfront capital expenditure to refurbish street lights, making it a financial challenge for many regional countries. However, several countries like Lebanon, Mauritania, and Saudi Arabia, have programs to install EE street lights. Lebanon for example, aims at replacing 9,000 street lamps with EE lighting.

One of the most effective methods to promote EE lighting are government regulations that make LED and CFL lighting more cost effective, thus attracting both investors and consumers. Jordan, for instance, has removed sales tax on EE lights, making it more affordable to consumers. Other countries have taken more effective measures by implanting bans on incandescent lights. In early 2015, the UAE banned the import of incandescent lightbulbs, which is expected to save the country $183 million a year on energy. Both Qatar and Tunisia have enacted government regulations to ban the import and sale of all types of incandescent lightbulbs.

One example of a comprehensive EE lighting initiatives is Qatar's Tarsheed Program, coordinated by the Ministry of Municipality and Environment and Qatar's General Electricity & Water Corporation (KAHRAMAA). This project is tackling EE lighting challenges in a multi-pronged approach by: creating public awareness campaigns that inform on the drawbacks of incandescent lights and promote EE lighting, developing standards for devices and tools used for efficient lighting and plumbing, as well as providing certifications for buildings with the highest level of EE lighting standards. The recent Qatari government regulation banning the import and sale of all high glowing incandescent lighting, further strengthens these measures. The savings derived from this program for the end of 2016 are estimated at 1185 GWh of electricity consumption saved, 638 million kg of CO_2 emissions reduced, and 172 Million QAR saved.

Algeria, Egypt, Iraq, Kuwait, Lebanon, Morocco, Palestine, Sudan, Tunisia, UAE, and Yemen have all joined the United Nations Environmental Program's (UNEP) en.lighten Global Efficient Lighting Program that seeks global strategies to phase out inefficient lighting. Partner countries in this program receive technical support, as well as strategic assistance to carryout EE lighting policies. 11 out of 20 Arab countries participation in the e.lighten Global Efficient Lighting Program will help assure the effectiveness of EE lighting plans in the region.

Table 32: Initiatives Supporting Phase-out of Inefficient Lighting (2016)

Country	Initiatives and Programs to Phase-out Inefficient Lighting
Algeria	• Joined the en.lighten Global Efficient Lighting Partnership Program
	"ECO-Lumiere" • Implemented by APRUE • The first phase of the program was launched in 2009 and completed in 2011 • Distributing one million CFLs, mainly in the household sector • Currently, the program is in its second phase, distribution of 250,000 CFLs
Bahrain	NEEAP measure: • Replacement of two million incandescent light bulbs in the household sector with CFLs and LEDs • Implementing agency is Electricity and Water Authority, in cooperation with the Ministry of Finance and the World Bank • Inefficient lamps in all government buildings were replaced by efficient lighting
	Bahrain introduced new regulation on EE requirements for non-directional household lamps in 2015. Clear and non-clear incandescent lamps will be phased out, but halogens will remain legal, as long as they meet efficacy requirements.
Egypt	*Joined the en.lighten Global Efficient Lighting Partnership Program*
	Issued a Ministerial Decree to prevent the import of General Lighting Service (GLS) lamps (i.e. incandescent lamps) with a wattage greater than 40 watts
	Provide technical assistance for transforming non efficient lighting systems by efficient ones in 7 government buildings, recommendations were suggested for replacing magnetic ballasts with electronic ones and GLS by CFLs
	Introduce LED lighting technology for indoor and outdoor purposes, based on the international standards specifications
	The government has committed to spending $18 million to replace 17 million incandescent lamps with CFLs
	Distribution of 12 million CFLs with a capacity of 20-23 W, mainly in the residential sector. The bulbs are distributed via sales outlets of electricity distribution companies.
Iraq	Joined the en.lighten Global Efficient Lighting Partnership Program
Jordan	Joined the en.lighten Global Efficient Lighting Partnership Program
	NEEAP measure
	Replacement of 1.5 million incandescent light bulbs with CFLs, mainly in the low consumption residential sector, implemented by the Ministry of Energy and Mineral Resources together with distribution companies
Kuwait	Joined the en.lighten Global Efficient Lighting Partnership Program
Lebanon	NEEAP measure
	• Replacing three million incandescent light bulbs with CFLs that is expected to reduce electricity demand by a minimum of 160 MW, saving around US$ 76 million annually for a period of four years and reduces annual carbon emissions by nearly 245,000 Mt of CO_2 • Implementing agency is LCEC
	Joined the en.lighten Global Efficient Lighting Partnership Program
Libya	*NEEAP measure*
	Distribution of two million CFLs.
Morocco	Joined the en.lighten Global Efficient Lighting Partnership Program
	"INARA" program
	The government has committed to spend $46.5 million to replace 6 million incandescent lamps with CFLs.
	Launched in 2008: • Replacement of 15 million incandescent light bulbs with CFLs, mainly in households and some administrative facilities by the ONEE • The first stage of the program included the distribution of five million CFLs door-to-door and in direct marketing campaigns • Customers paid 1 DH per CFL integrated in a monthly electricity bill over 24 months • By the end of 2010: • 4.5 million lamps have been replaced in approximately 650,000 households • On average, customers observed about 22% reduction in average monthly electricity consumption

Country	Initiatives and Programs to Phase-out Inefficient Lighting
Morocco	• From 2008 to 2010, Morocco reduced its peak load by 177 MW (Guasmi, 2011) • Currently, ONEE is in the implementation process of the second phase of the INARA program, distributing 10 million lamps • The tendering process has been completed and the first batch of lamps was delivered by September 2014 • With the implementation of the second phase, Morocco plans to reduce 330 MW of peak load
Oman	*None*
Palestine	Joined the en.lighten Global Efficient Lighting Partnership Programme
Qatar	"TARSHEED"
	• Ban of import of incandescent light bulbs of 100 W and 75 W • Qatar plans to implement major infrastructure projects with LED integrated technologies
Saudi Arabia	The Saudi Energy Efficiency Program (SEEP) is in the process of drafting regulations that focus on the phase out of inefficient light sources in residential and commercial/professional lighting
Sudan	Joined the en.lighten Global Efficient Lighting Partnership Program
	NEEAP measure
	Distribution of two million CFLs by the Electricity Regulatory Authority
Syria	None
Tunisia	Joined the en.lighten Global Efficient Lighting Partnership Program
	Import and sale of incandescent light bulbs is banned
UAE	Joined the en.lighten Global Efficient Lighting Partnership Program
	• The import of incandescent light bulbs is banned • UAE is implementing various lighting refurbishment projects replacing inefficient lights with LEDs. Examples include refurbishment of the Dubai Police Traffic Department Headquarters Building in Al Barsha, the Dubai Police's Officers Club in Al Garhoud, and others (D'Mello, 2014)
Yemen	• Joined the en.lighten Global Efficient Lighting Partnership Program

4.2.4. Industrial EE Programs

Around six regional countries have comprehensive industrial EE programs: Algeria, Egypt, Kuwait, Jordan, Morocco, and Tunisia (See Table 26 for details). Some countries, like Lebanon have produced reports on industrial EE that reflect steps towards creating policies that will increase industrial EE. Most strategies focus on EE audits and setting targets for reducing energy consumption, which help industries enact cost-cutting EE measures. For example, Jordan's Mobile Energy and Environment Clinic Program, initiated by Amman Chamber of Industry, provides full energy audits and offers support to cover 90% of energy audit costs. Additionally, Morocco has now implemented legislation for energy audits. So far, Morocco's ADEREE has conducted 58 industrial energy audits, funded primarily by the African Development Bank and European Investment Bank.

Few countries have implanted comprehensive strategies to reduce energy intensity in the industrial sector. Algeria's National Energy Efficiency Program, covering 2015 to 2030, focuses on reducing energy consumption in the transportation and industrial sectors. The program's stated goal is to reduce industrial sector energy consumption by 34 million TOE. In 2011, Algeria's APRUE implemented the "programme triennal d'efficacité énergétique" that carries out energy audits, conducts feasibility studies that enable companies to precisely define technical and economical solutions best suited for reducing energy consumption, and provides co-financing for economically and technologically viable EE projects.

Egypt's Industrial Energy Efficiency (IEE) project started in January 2013 with a $3,950,000 fund from the Global Environmental Facility (GEF) and additional input from its Egyptian counterparts, equivalent to $24,121,000. The United Nations Industrial Development Organization (UNIDO) implements this project, with the Egyptian Environmental Affairs Agency as the lead executing partner and full cooperation from the Industrial Development Authority, the Egyptian Organization for Standardization, the Industrial Modernization Center, and the Federation of Egyptian Industries. It is designed to provide support to all stakeholders that are involved in the energy supply chain for the industrial sector, excluding national power plants and the national grid. The project tackles the following: (1) government support, (2) awareness raising, (3) capacity building, (4) financing and (5) implementation of energy efficiency projects in factories. These aims are achieved through five components: a national program to define energy benchmarks and energy efficiency policy, awareness raising for industrial energy efficiency, capacity building for energy efficiency services, financing for energy efficiency improvement projects, and finally implementation of energy management systems and system optimization.

Table 33: Industrial EE Programs (2016)

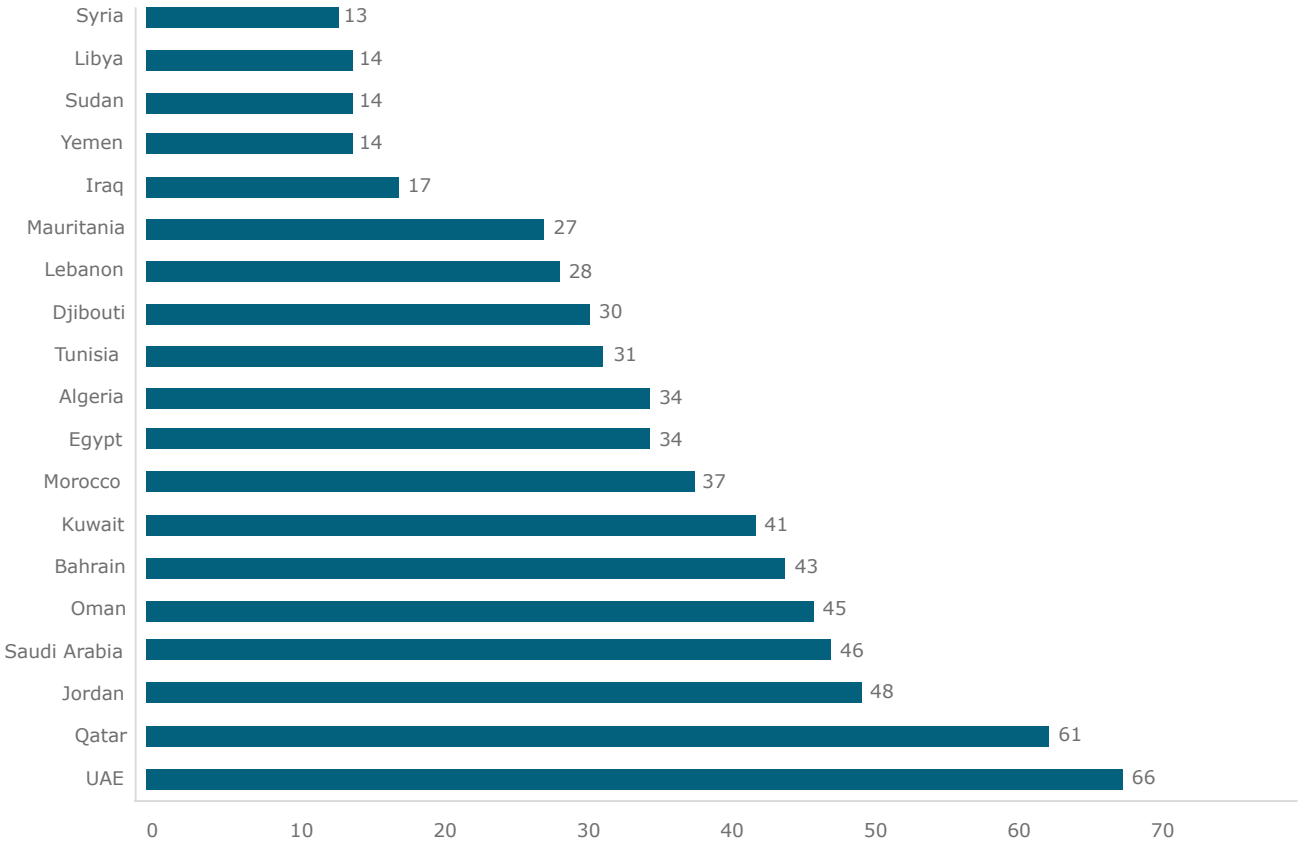
Country	Initiatives/Programs/Projects to improve Industrial EE
Algeria	National Energy Efficiency Program (2015-2030) focuses on EE consumption in the transport and industry sectors. The program aims to bring industry to a moderate energy consumption. More than 34 million toe are expected to be saved for the industrial sector.
	Algeria Energy Efficiency Project focus on energy efficiency in heat and power (80%) and the general industry and trade sector (20%).
	Programme Triennial D'efficacité Énergétique (2011-2013), initiated by APRUE to promote EE in the industrial sector has three main targets:
	• To carry out 130 energy audits in the industrial sector by 2013
	• To conduct feasibility studies, enabling companies to precisely define technical and economical solutions best suited for reducing energy consumption
	• To co-finance additional costs linked to the introduction of EE into technically and economically viable projects.
Bahrain	• Scattered EE projects within individual industries
Egypt	• The Industrial Energy Efficiency (IEE) Project started in 2013, with a US$ 3,950,000 fund from the Global Environmental Facility (GEF) and input of the Egyptian counterparts that is equivalent to US$ 24,121,000 in cash and in-kind. Implemented by the United Nations Industrial Development organization (UNIDO), with the Egyptian Environmental Affairs Agency as the lead executing partner and in full cooperation with the Industrial Development Authority, the Egyptian organization for Standardization, the Industrial Modernization Center and the Federation of Egyptian Industries. It is designed to provide support to all stakeholders that are involved in the energy supply chain for the industrial sector (excluding national power plants and the national grid). The project tackles the following: (1) government support, (2) awareness raising, (3) capacity building, (4) financing and (5) implementation of energy efficiency projects in factories. Their project includes five components:
	Component 1: National program to define energy benchmarks and energy efficiency policy
	Component 2: Awareness raising on industrial energy efficiency and management in industry
	Component 3: Capacity building for energy efficiency services
	Component 4: Access to finance for energy efficiency improvement projects
	Component 5: Implementation of energy management systems and system optimization
Iraq	Scattered EE projects within individual industries
Jordan	Mobile Energy and Environment Clinic Program, initiated by Amman Chamber of Industry. • Launched in 2009, aims to improve EE in industrial facilities. • Provides full energy audits and offers support to cover 90% of energy audit costs.
Kuwait	Energy Efficiency Technology (EET) program aims to reduce energy demand by improving energy efficiency in several sectors, including industry. • Aims to reduce energy consumption by 10 % in existing buildings and industries and by 30% in the new buildings.
	Scattered EE projects within individual industries
Lebanon	• Lebanon has produced a report about IEE called "Energy Efficiency in the Industrial Sector" that shows government interest in EE. • There are some scattered EE projects within individual industries.
Libya	Scattered EE projects within individual industries
Morocco	Implementation of the Law 47-09: • 58 energy audits have been initiated by ADEREE, of which eight were financed by the European Investment Bank and 50 by the African Development Bank.
Oman	Scattered EE projects within individual industries
Palestine	Scattered EE projects within individual industries
Sudan	Scattered EE projects within individual industries
Syria	Scattered EE projects within individual industries
Tunisia	Scattered EE projects within individual industries
Yemen	Scattered EE projects within individual industries

4.2.5. Corruption Perception Index

The Corruption Perception Index, indicates the level of corruption in each country and is based on various indicators such as: the existence of anti-corruption laws, press freedom, transparency in public expenditure, independency of judicial systems, etc. The higher the score a country obtains, the less corruption the country faces. United Arab Emirates ranks on top of the list (24th worldwide) with a score of 66, whereas Syria, Libya, Sudan and Yemen remain at the bottom of the list. In general, these numbers have decreased from the two previous years. However, 90% of the countries in the region have scored below 50, indicating that there is no positive change or progress towards combating corruption in the region. Political corruption in particular remains a huge challenge. For example, falling oil prices and a costly military intervention in Yemen have only strengthened the country's austerity resolve. On the other hand, there is political recognition that solid structures and a clean business environment are needed to attract foreign investment.

As many states feel confronted by existential threats, it is more important than ever to make combating corruption a top priority in order to give governments more legitimation. As reducing corruption is part of the new Sustainable Development Goals, enlightened decision-makers are starting to realize that development and anti-corruption must be interlinked. But citizens urgently need their governments to move beyond conceptualization to actually take long-term action and civil society must have the space to be a serious partner in the fight against corruption. Governments have demonstrated that they cannot do this alone.

Figure 18: Corruption Perception Index (2016)



Source: www.transparency.org

4.3. Institutional Capacity Final Scores and Ranking

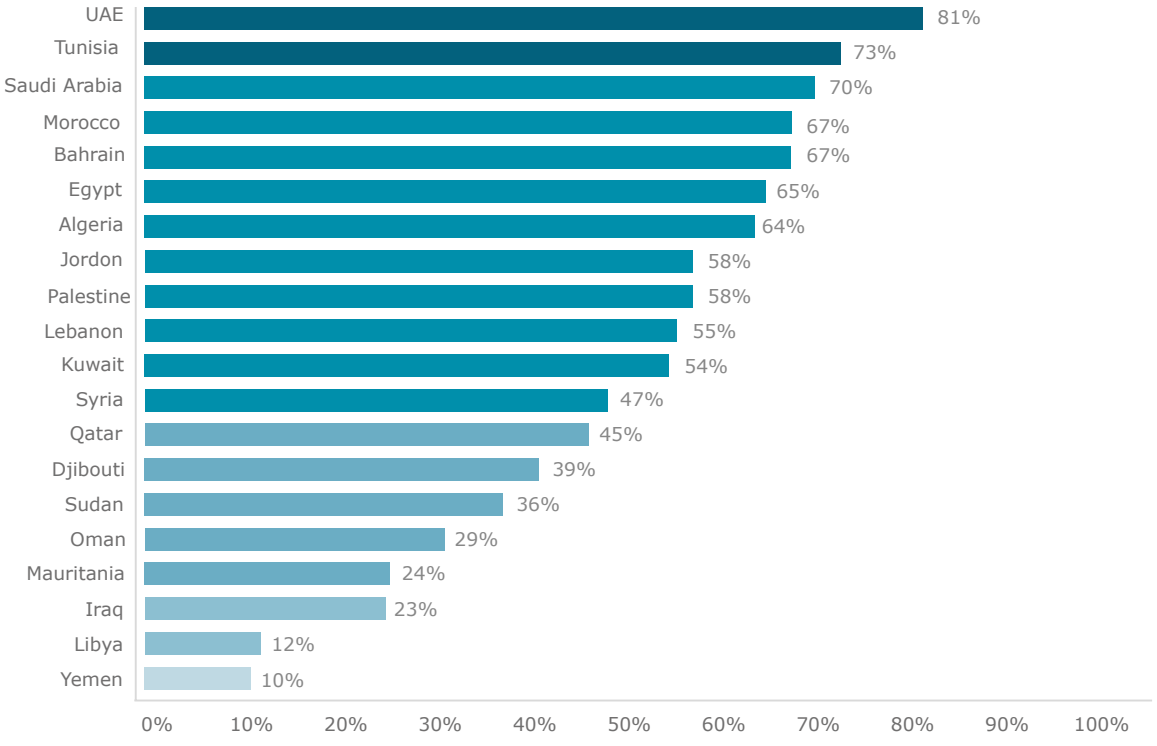
The final scores for institutional capacity are presented below in figure 19. The UAE, Tunisia, Saudi Arabia, Morocco, and Bahrain scored the highest in institutional capacity. Despite some progress, many Arab countries need more effective EE governance. Agencies responsible for EE tend to be scattered amongst different ministries and institutions, making it challenging to develop and enforce effective EE policy in the region. Even more problematic, that several counties lack EE regulation bodies all together.

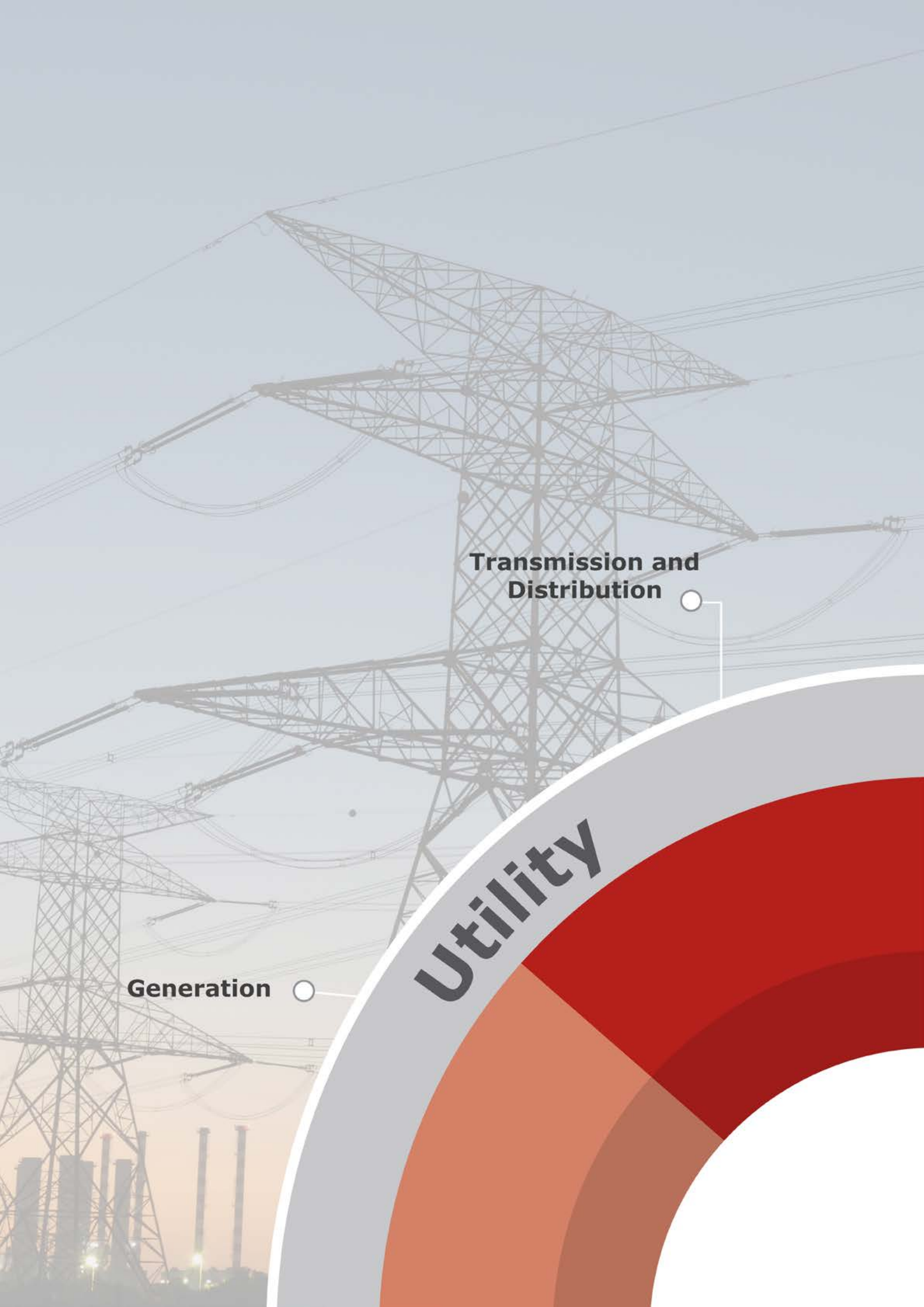
A marked area of recent progress is the proliferation of LEED buildings, particularly in the GCC region. Currently, a majority of Arab countries have built less than 10 LEED certified buildings in 2016. Qatar, Lebanon, Egypt, Saudi Arabia, and the UAE have constructed more than 10 LEED certified buildings in 2016, with the UAE having the 10th highest number of LEED certified constructions in the world.

Solar water heaters have the potential to drastically reduce energy consumption in the region, given its location in the sunbelt. However, few countries, namely Palestine, Tunisia, and Lebanon, have made policies that promote solar water heaters. The current energy subsidies in the region do not incentivize residential and commercial consumers to make the initial investment in installing solar water heaters.

EE policy in the region has made concerted efforts to plan for reducing dependence on inefficient lighting. Recently, numerous countries have carried out such plans through initiatives, such as increasing tariffs on incandescent lights, making LED and CFL lighting more cost effective. Further, 11 out of 20 Arab countries are participating in the United Nations Environmental Program's (UNEP) en.lighten Global Efficient Lighting Program that seeks global strategies to phase out inefficient lighting.

Figure 19: Institutional Capacity Final Scores and Ranking




Transmission and
Distribution
Utility
Generation

5. Utility

The utility section assesses the efficiency of power generation, transmission, and distribution systems. Generation is measured by two indicators: share of renewable energy and power generation efficiency. Transmission and distribution, on the other hand, are measured by one indicator: the percentage of losses in the transmission and distribution networks.

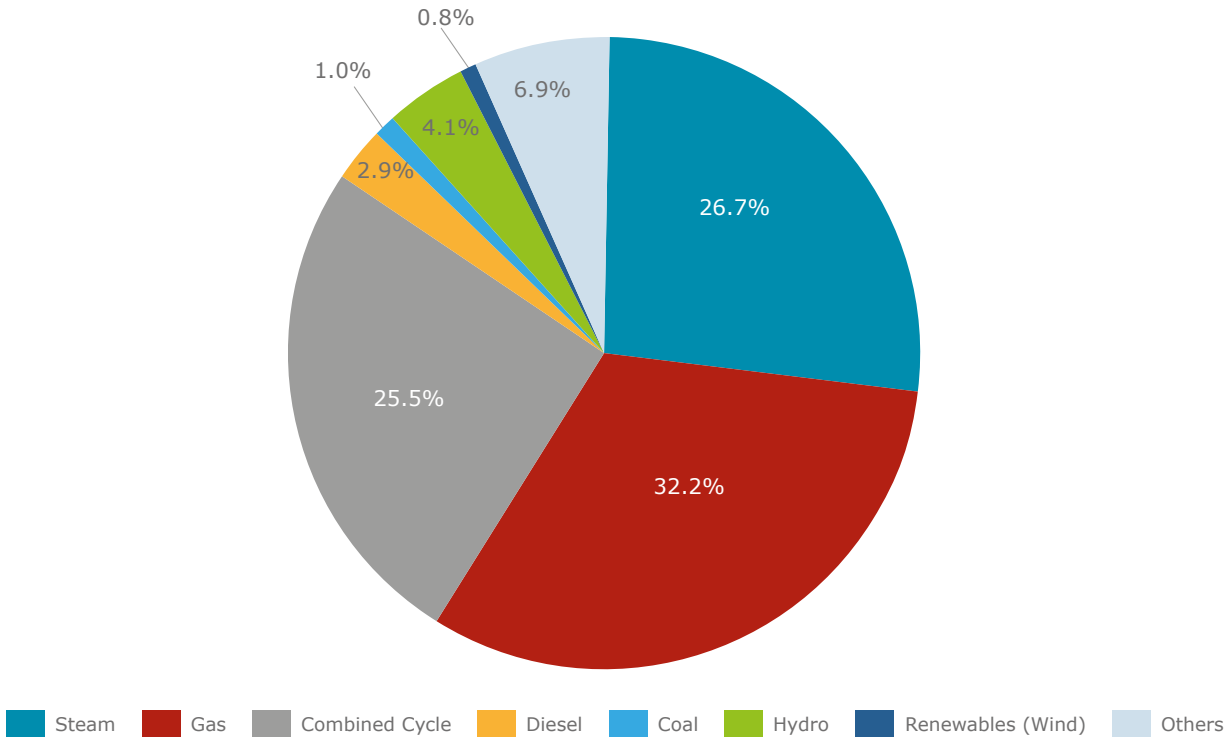
Table 34: Utility Indicators

Category	Factors	Indicator	Score/Measuring Unit
Utility	Power Generation	Power generation efficiency	National average percentage
		Share of renewable energy in generation mix	Percentage of total installed capacity
	Transmission and distribution	Transmission and distribution losses (including technical and commercial losses)	Percentage

5.1. Power generation efficiency

The generation efficiency of power plants is an expression of how efficiently they convert one form of energy into another. It is measured as the ratio of useful energy output, most commonly electricity, to the energy input, i.e. coal or gas. The efficiency of different power plants varies greatly and depends on numerous factors, such as: fuel type, the age and type of the operating power plant, level of maintenance and finally the load factor.

Figure 20: Installed Capacity by Generation Type



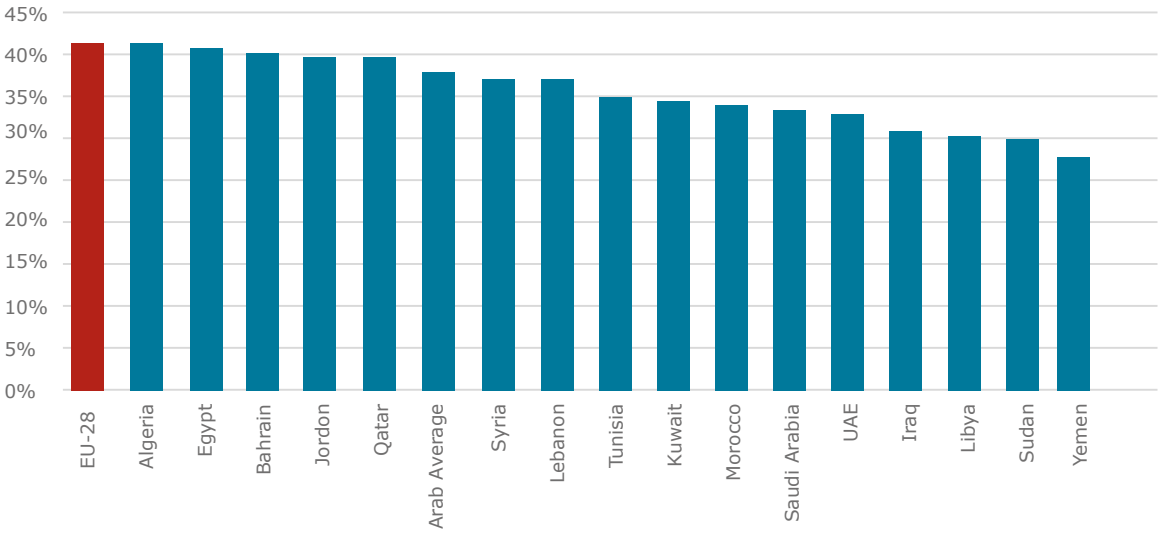
Electricity Genration Efficency:

- **Oil Fired Steam Power Piant: 38.44%**
- **Coal Fired Steam Power Piant: 33.44%**
- **Gas Fired Power Paint: 17-33%**
- **Combined Cycle Gas Turbine Power Paint: up - to 85%**
- **Diesel Engine Power Paint: 35-42%**
- **Hydroelectric: 85-95%**
- **Wind Turbine: 34%**

Almost 95% of electricity in the Arab region is still produced from fossil fuel operated power plants, 5% from hydropower, and only 1% is produced from renewable energy. As seen in Figure 20, only 25.5% of the electricity generated in the Arab region is produced by combined cycle, which is the most efficient technology to produce both base and peak load electricity from fossil fuel. Burning fossil fuels in the energy sector is the primary source of CO_2 emissions; thus, the higher a power plant's efficiency, the lower the environmental impact (assuming that a gain in efficiency generates an equivalent absolute decrease of fossil fuel input). This also depends, to some degree, on the type of technology used and the level of abatement technology installed (EEA, 2015). Combined cycle gas power plants, for example produce 65%, 53% and 39% less CO_2/kWh than lignite steam, fuel oil, and gas turbine power plants, respectively (Eurelectric, 2003). As most energy losses arise in the generation phase of electricity, various energy conservation measures can be applied in the Arab region. Replacing old and low efficiency motors and generators in existing power plants with new and more efficient ones will increase power generation efficiency. Although it requires an initial high investment, switching to more efficient fuels and generation technologies, such as gas combined cycle, can improve energy output per unit of fuel utilized, while reducing the volume of carbon dioxide and other air pollutants emitted. Developing an energy management system for power plants, having periodic equipment maintenance and monitoring, as well as sustaining good housekeeping might have moderate to significant investment costs, but immediate short term energy conservation potential. Finally developing tariff structure reforms is an efficient measure to shift electricity consumption from peak demand periods to non-peak demand periods, reducing the need for any further investment in peak load power generation facilities.

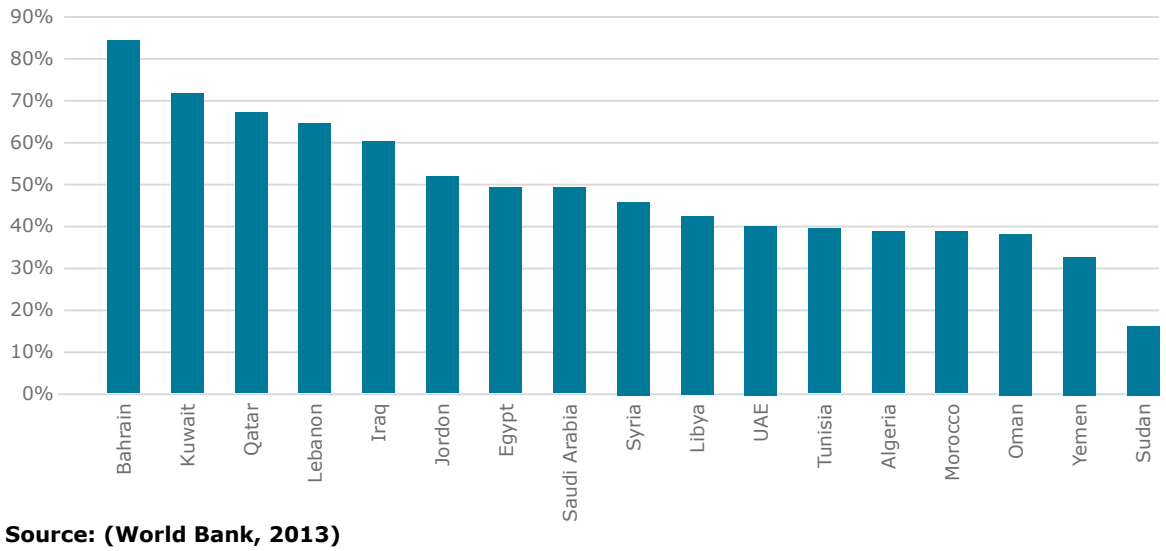
Figure 21 illustrates power generation efficiencies in the region, compared to the regional average and the EU-28 average. Within Arab countries, efficiencies vary greatly: from 42% in Algeria to 29% in Yemen, with an average efficiency of 36%. The regional differences in energy mix, technology used, and power generation types could be part of the explanation for the variances. The region's average is, however, still below the EU-28 average power generation efficiency (AUE, 2015). Although Figure 22 shows CO_2 emissions from both electricity and heat production, the graph still provides a good insight on the volume of CO_2 emissions from electricity production in the Arab region, as the amount of heat production in the region is very minimal.

Figure 21: Power Generation Efficiency in the Arab Region



Source: (UAE, 2015)

Figure 22: CO_2 emissions from electricity and heat production, total (% of total fuel combustion), 2013



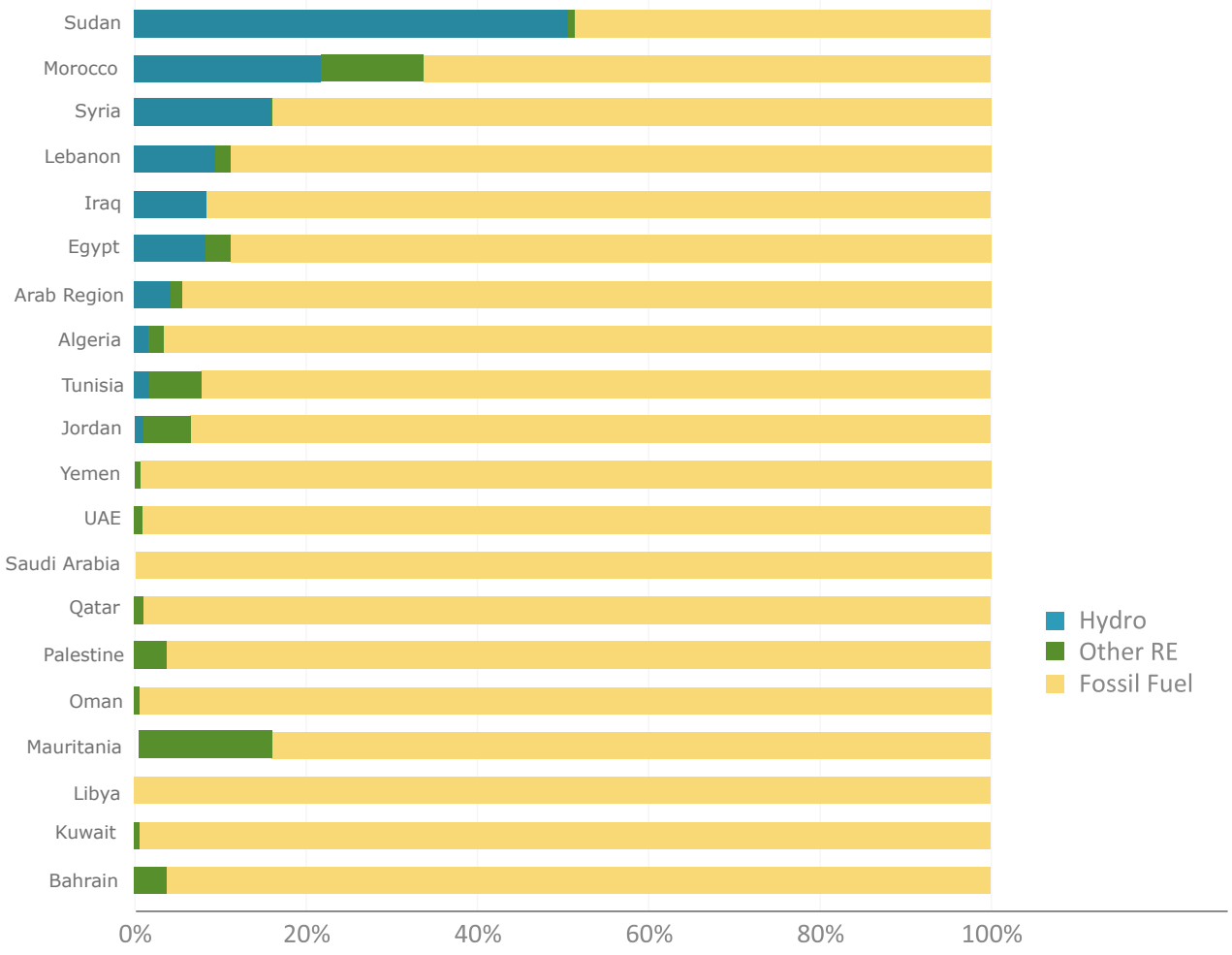
Source: (World Bank, 2013)

5.2. Share of Renewable Energy

Renewable energy still contributes only a minor share of total electricity production in the Arab region. On average, fossil fuels are responsible for 95% of electricity production in the region, whereas renewable energy is only responsible for the remaining 5%, of which Hydro constitutes 80% of total electricity production from renewable energy. Renewable energy presents a great opportunity to not only gain access to a vast and inexhaustible energy supply, but also to reduce the total amount of CO_2 emissions from the region and its contribution to global warming. The power generation sector alone is responsible for 49% of total CO_2 emissions from fuel combustion in the region. In addition to achieving energy security and reducing environmental pollution, renewable energy plays an important role in social development and the creation of direct and indirect jobs.

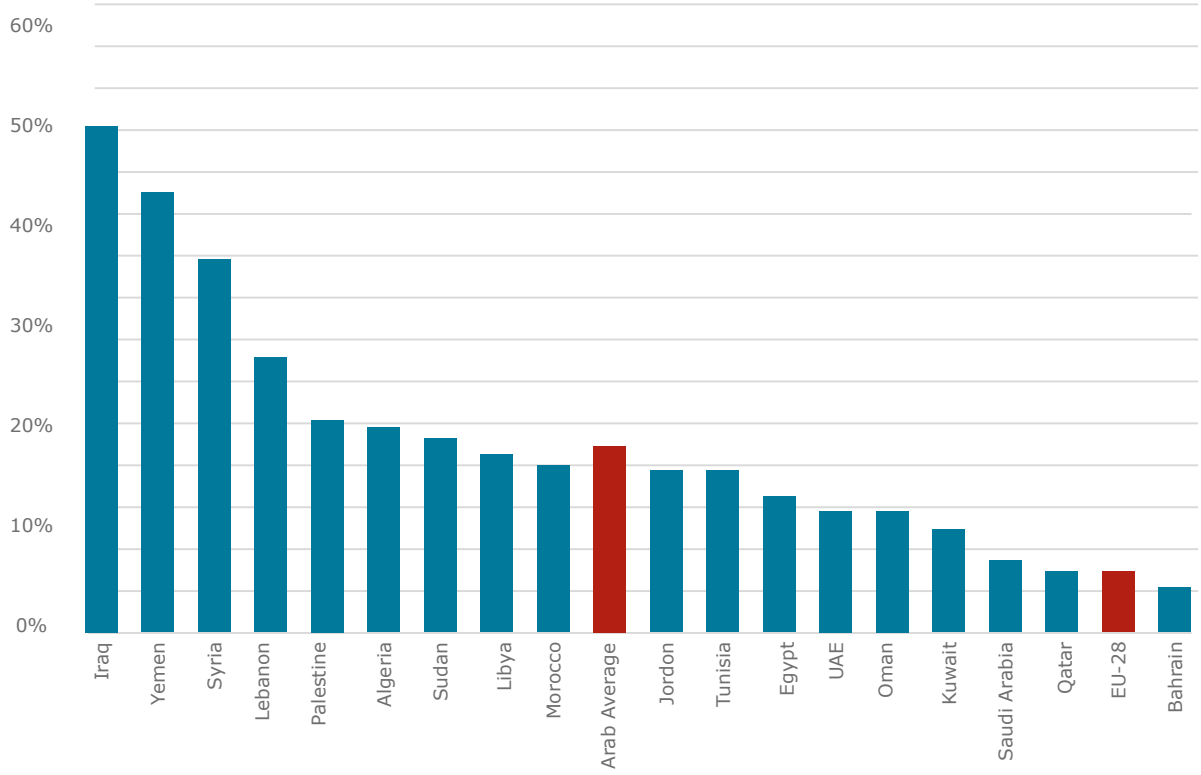
As seen in Figure 22, the share of renewable energy in the energy mix differs greatly between countries in the Arab region. We notice that renewable energy constitutes less than 1% of the total energy mix of all the oil and gas exporting countries, with the exception of Algeria where hydro and renewables are responsible for around 3.2% of the total installed capacity. Oil importing countries show a better trend in reliance on renewable energy, where renewables (including hydro) constitute 33.3%, 15.7%, 12.4%, 10.5%, 10% and 7.4% of the total installed capacity in Morocco, Mauritania, Egypt, Lebanon and Tunisia, respectively. Nonetheless, it is evident that the region in general is still heavily dependent on fossil fuels and is adopting renewable energies at a rather slow pace. Furthermore, Hydro generation is nearly fully exploited, leaving solar and wind energy as the future of sustainable energy in the region. (El-Khayat, 2010)

Figure 23: Share of Renewable Energy, 2016 (% of installed capacity)



5.3 Transmission and Distribution Losses

Figure 24: Transmission and Distribution Losses in Arab Region, 2015 (% of Output) (AUE, 2015)



In addition to energy losses in power generation, a significant amount of energy losses occur in the transmission and distribution of electricity in the Arab region. In general, there are two types of transmission and distribution losses: technical losses and commercial losses.

Technical losses - Electricity generated in the power sector has to pass through a complex series of cables, transformers, converters, overhead lines, and other equipment in order to reach the end user. Energy loss mainly occurs when energy is lost as heat through the conductor, dissipated into a magnetic field, and absorbed in the insulating material. Other technical losses also occur in the transformers, due to lack of maintenance in other equipment. These losses usually increase when the load or the end user is located at significant distance from the power generation facility.

Commercial losses - Represents the highest percentage of transmission and distribution losses in countries, such as Iraq, Yemen, Syria, Lebanon, Jordan, Algeria, etc., and are usually due to theft and inefficient meter readings.

As seen in Figure 24, the transmission and distribution losses in the Arab states are well above those in Europe. These losses exceed 20% in Algeria, Palestine, Lebanon and Syria, and reach values of 43% and 49% in Yemen and Iraq, respectively. It is evident, however, that the GCC countries have the lowest transmission and distribution losses in the region, with Bahrain's losses below the EU-28 average. Due to the extreme losses in power transmission and distribution in most Arab countries, there is a dire need to manage losses and improve efficiency in order to strengthen system reliability, avoid related financial losses to the power utility, and reduce the overall environmental impact of the energy sector. Reducing these losses is especially important during peak load times when usage and costs are at their highest.

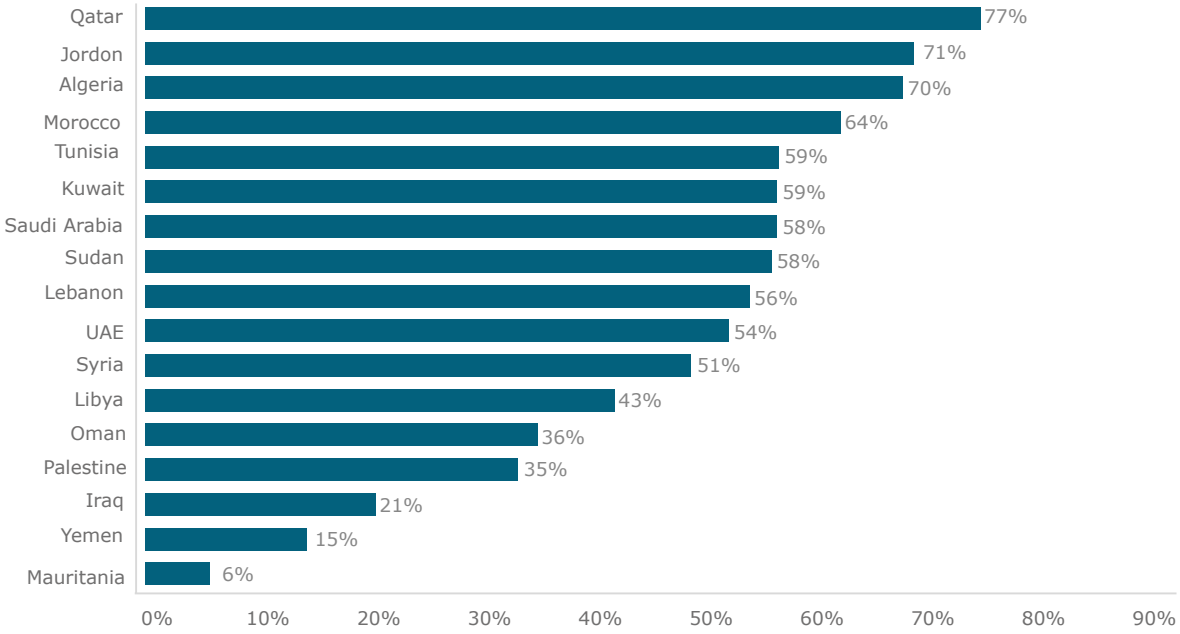
Low maintenance, overloaded, and aged transformers are a major reason for these high losses in the region. Although their prices are higher than ordinary transformers, high efficiency transformers not only offer technical advantage but also environmental benefits. These transformers usually utilize high quality magnetic material and are designed so that they are able to cool more efficiently. Using superconducting cables results in lower weight and heat losses compared to conventional cables. Furthermore, losses can be mitigated by increasing the availability of reactive power and improving the power factor by installing capacitor banks along the transmission and distribution lines. By adopting FACTS or a Flexible AC Transmission System the utility company does not only improve the power factor, voltage control, and voltage stability; but it also increases overall efficiency of power transmission and reduces delivery costs.

Nevertheless, there are a number of challenges involved in trying to mitigate transmission and distribution losses. Many countries face difficulties identifying the source of the losses and subsequently the most appropriate method of managing them. Development of efficient metering

and billing systems may be obstructed by political turmoil. Countries may ultimately lack the resources to invest in appropriate upgrades of existing infrastructure. Despite these challenges, there is potential to reduce transmission and distribution losses in the region, since losses are primarily of a non-technical nature.

Finally, the involvement of the utility sector in promoting demand side management (DSM) is an essential component for reducing the amount of electricity generation required by utility companies. Diverting funds and investments, which would have otherwise been spent in the installation of additional power plants and transmission & distribution networks, into demand side management programs for customers is an important responsibility for the utility sector. These DSM programs can include awareness campaigns and workshops on energy and load reduction programs. Furthermore, demand side management also plays an important role in job creation, reducing electricity prices for consumers, cutting down CO2 emissions, and finally reducing dependency on foreign energy sources especially for energy importing countries. (UNIDO, 2006)

Figure 25: Utility Final Scores and Ranking



*Djibouti is missing from the ranking as not enough data was collected on its utility sector

*Mauritania is missing some data for the utility sector which might explain its low score

6 Final Scores and Trend Analysis

Figure 26 and figure 27 below represent the final scores and ranking of countries for the AFEX – Energy Efficiency 2017 and 2015 respectively. In general, there was a clear improvement in the region in energy efficiency; almost every Arab state improved their efficient use of energy and developed their energy efficiency regulatory and institutional infrastructure, compared to the rankings presented in the 2015 AFEX EE. In 2015, we notice that 6 out of 17 or around 35% of the evaluated regional countries had final EE scores above 50%. In this year's edition of the AFEX EE, 11 out of 20 evaluated countries or 55% of the regional counties have EE scores above 50. It is important to note that although some countries fell behind in the rankings compare to the AFEX EE 2015, not a single country obtained a lower EE score in 2017 than it did in 2015. Rather some countries made more significant EE improvements than other countries in the region. For example, Qatar fell in ranking from 4th in 2015 to 9th in 2017; however, their EE scoring went up by 4%.

Tunisia remains in the top ranking and a leader in energy efficiency in the Arab region. Tunisia has focused immensely on developing its energy efficiency sector and emerged ahead in the policy framework, developing the most comprehensive EE laws, bylaws, and targets as well as implementing the third phase of their EE national plan. Tunisia also obtained the top ranking in institutional capacity and their ability to enforce EE regulations and achieved their intended targets. Jordan and Morocco pick up the 2nd and 3rd place gaining a score of 70% and 69% respectively. The UAE remains a leader in EE in the GCC region and has achieved a vast improvement in implementing energy efficiency measures by decreasing its fuel subsidies, providing incentives and funding for EE projects and expanding the number of energy efficient buildings. Palestine attained the 5th place this year after being in the 4th place in 2015. Although Palestine's final score increased by 6% this year the inclusion of Mauritania in this year's AFEX and the subsidy reforms underwent by various Arab states resulted in electricity prices that are higher than those in Palestine. These high electricity prices pushed a few Arab states ahead of Palestine in energy pricing as the later was the benchmark for electricity prices in the region in the AFEX 2015.

Egypt and Lebanon both improved immensely ranking 6th and 7th with an increase of 19% and 13% respectively from 2015. In addition to preparing its second NEEAP Egypt, has shown significant subsidy reforms in both its electricity and fuel markets raising its residential electricity prices by almost 40% and its gasoline prices by 30%–45% in 2016. Learning from their first NEEAP Lebanon has already started implementing their second NEEAP 2026-2020 as well as continued funding energy efficiency projects for the private sector through their EE fund program NEEREA.

Bahrain, Saudi Arabia and Syria earned a score of 50% which is a significant move forward in their energy efficiency plans and implementation capacity as these countries had a score of 36%, 33% and 31% respectively in 2015. Bahrain is preparing its first NEEAP with the support of UNDP and Saudi Arabia emphasized in its Vision 2030 on the importance of sustainable and efficient energy planning in the Kingdom's future. Although Syria has been suffering from severe political and economic turmoil, the country still managed to implement several EE policies, increase its electricity prices significantly and provide a new fund for solar water heaters. Although Qatar had a drawback in terms of ranking among other Arab countries, Qatar still showed around 4% improvement from 2015. Although Djibouti still lacks any prepared or under-development NEEAP or EE laws, the country earned a score of 38% mainly due to the high prices of electricity and petroleum products in the country which are the highest in the Arab region.

The last eight counties don't show any significant changes in their ranking compared the 2014 edition of the AFEX-EE with the exception to the addition of Djibouti, Mauritania and Oman. Both Oman and Sudan increased their electricity tariffs in 2016 while Kuwait, Mauritania, Iraq, Libya, and Yemen still lack efficient EE laws and plans as well as the enforcement power of their institutional capacity. Energy prices in Iraq, Libya, Qatar and Saudi Arabia are significantly low in the region and the countries have not undergone many subsidy reforms.

Low energy prices have created a long time barrier to the development of energy efficiency behaviors at the end consumer side which forms a big challenge for heavily energy subsidized countries to pursue energy efficiency measures. In general, and for the first time, the Arab states have started significant reforms in their energy sectors cutting subsidies for electricity and fuel products. Nonetheless, continuous reform in each country's energy subsidy structure is essential to both shift government spending on additional electricity generation plants as well as encourage consumer investment in energy efficient equipment and the adoption of energy efficiency measures.

With a rapidly growing population, expanding economy and extensively high demand for energy resources, the efficient use of energy has become a top a top priority for many countries in the Arab region. In order to ensure a sustainable energy future and reduce the impacts posed by climate change on the region, many Arab countries are moving towards careful energy planning with targeted measures, robust monitoring and evaluation procedures. The AFEX Energy Efficiency proves that the majority of the countries in the Arab region are implementing reform actions, setting targets and action plans as well as adopting new policies and regulations to enforce the adoption of energy efficiency measures and control the consumption of energy along the different sectors. Nonetheless, these key activities should be accompanied by dedicated resources, competent staff, a collaborative approach and, most importantly, true commitment and political will for the pursuit of EE.

AFEX Energy Efficiency 2017 Results

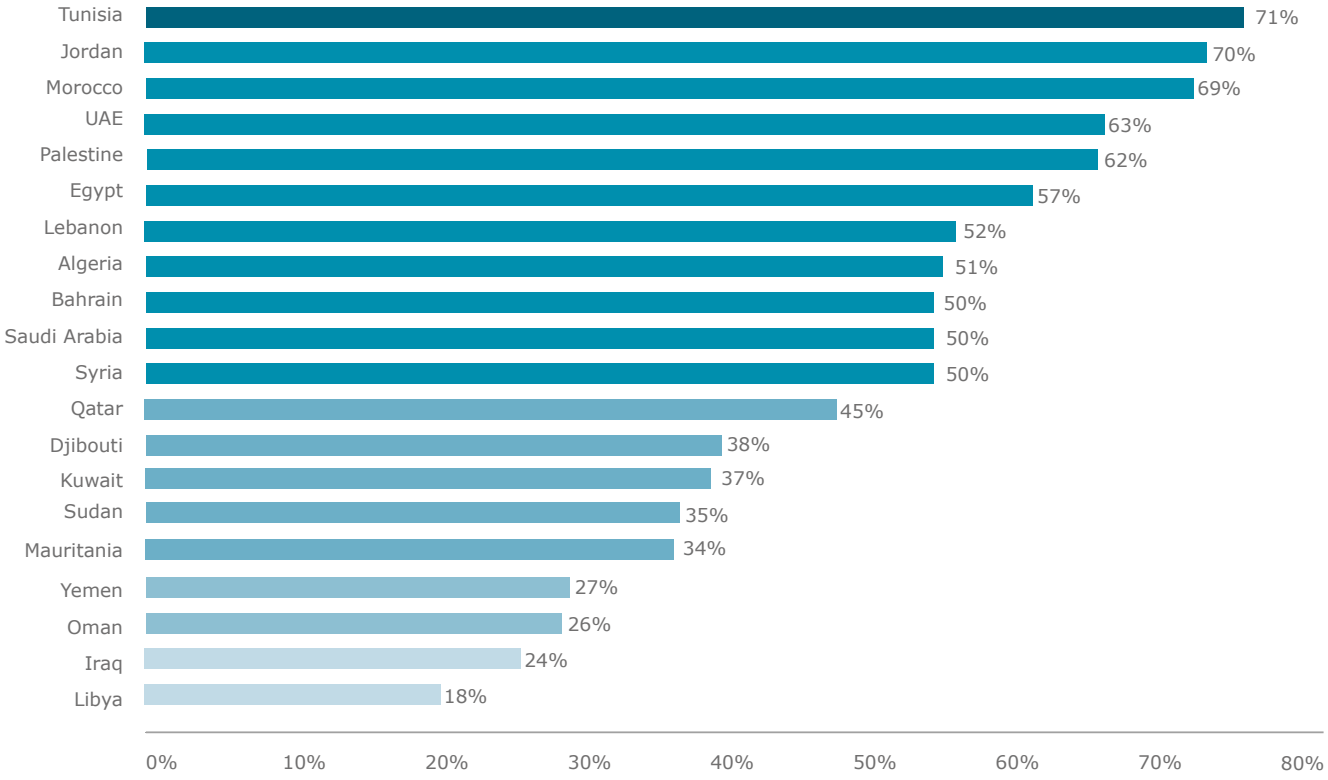
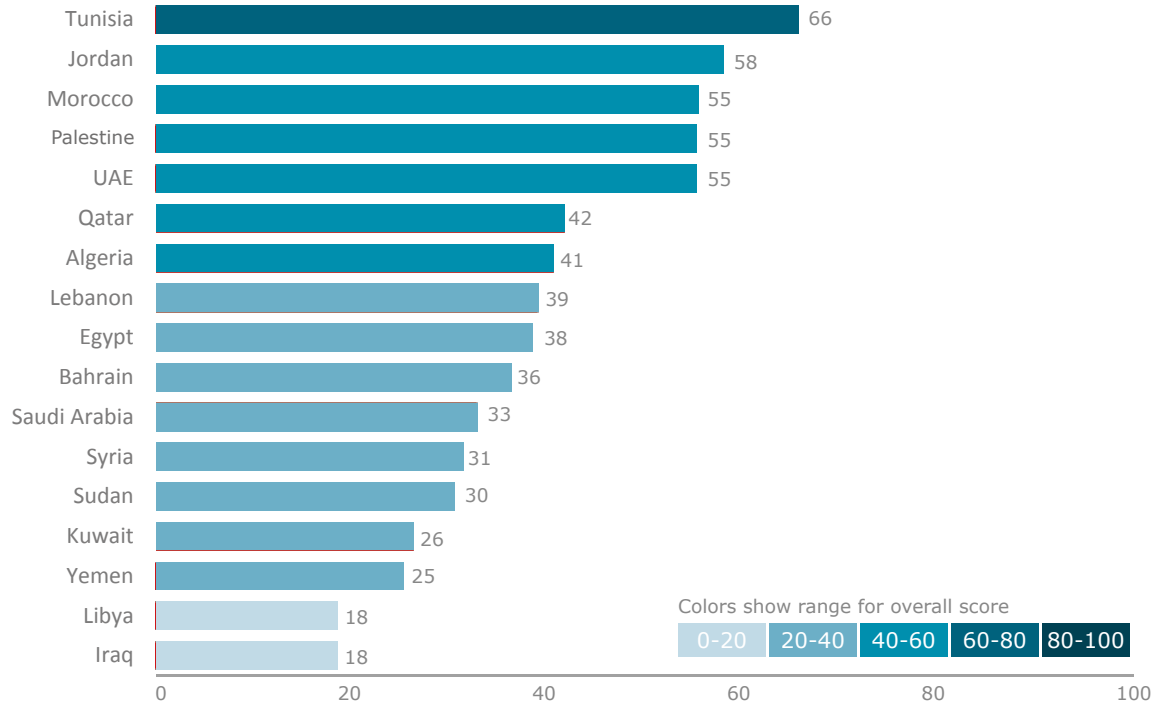


Figure 27: AFEX Energy Efficiency 2015 Results



Case Study

Socio-Economic Impact of EE in the Arab Region: Job Creation in Energy Efficiency in Tunisia

EE engages with a vast array of economic activities that spur job creation across many sectors, including manufacturing EE materials and components, building and installation, as well as the auditing and licensing process of EE initiatives. Tunisia's efforts to reduce primary energy demand and carbon emissions have resulted in EE and renewable energy (RE) job creation. Project RE-ACTIVATE ("Promoting Employment through Renewable Energy and Energy Efficiency in the Middle East and North Africa"), implemented by the German Society for International Cooperation (GIZ) on behalf of the German Ministry of Economic Cooperation and Development (BMZ), has studied the socio-economic impact of RE and EE initiatives in Tunisia. The Tunisian case demonstrates the potential socio-economic impact of EE initiatives to create jobs in the Arab region.

The Push for Energy Efficiency in Tunisia

As part of its commitment and contribution to combating climate change, the Tunisian government has set ambitious targets to reduce its carbon emissions by 2030. Compared to 2010 levels, Tunisia plans to lower its carbon intensity by 41% by 2030 and the carbon intensity of the energy sector by 46% by 2030 (UNFCCC, 2015). The National Agency for Energy Management (ANME) is a national entity responsible for promoting energy efficiency in Tunisia. Since the early 1990s, ANME has been promoting the adoption of energy efficient technologies and practices through various programs, such as audits: implementation of energy saving measures, the preliminary selection of energy efficient technologies, and finally public awareness on the importance of energy efficiency.

The Tunisian EE policy hinges on institutional systems of audits and contract-programs that encourage both cooperation with and enforcement of EE policies between the ANME and public and private economic agents. EE audits employ around 160 auditors, who are usually experts or consulting engineers accredited by the ANME. Energy audits are mandatory in Tunisia and applied every 5 years for companies above a certain threshold of annual energy consumption:

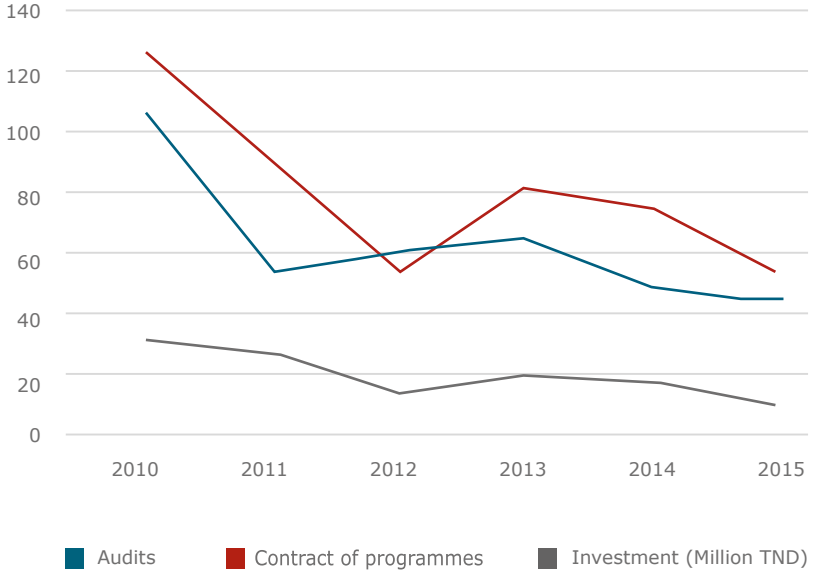
800 toe per year for the industrial sector

500 toe per year for transport companies

500 toe per year for the tertiary sector buildings (hospitals, hotels, etc.)

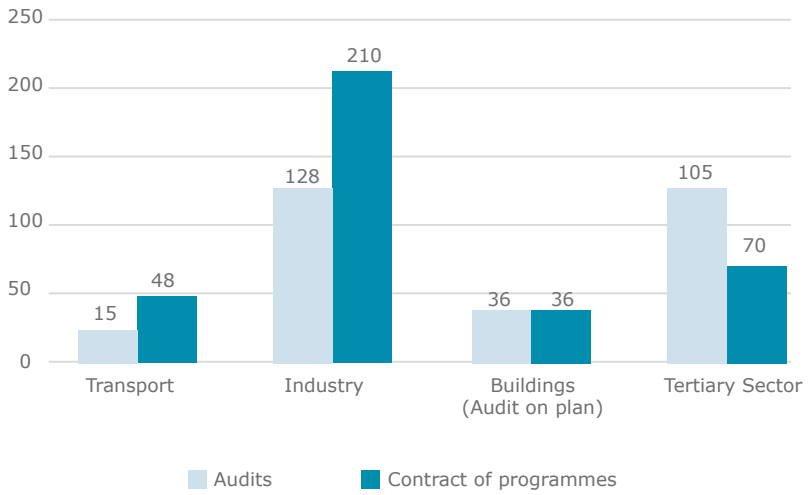
200 toe per for the new building sector

Figure 28: Energy audits conducted between 2011 and 2015



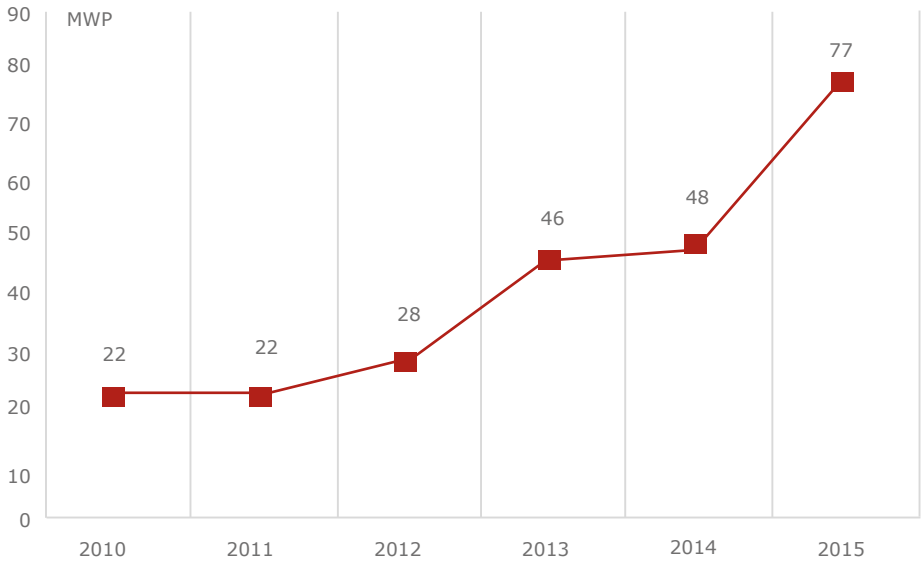
As seen in Figure 28, the number of energy audits conducted between 2011 and 2015 dropped by 22% from the number of audits conducted in the period between 2006 and 2010. This decrease in energy audits, contacts programs, and eventually the total volume of investment was mainly due to the political and economic turmoil in Tunisia during that period. Nonetheless, 2011-2015 served as a review period to develop forthcoming strategies for the period between 2016 and 2030. Despite the decrease in EE activities during the period 2011-2015, almost 40.270 buildings or 4.3 million sqm complied with the building thermal regulations, of which 82% where residential buildings.

Figure 29: Energy audits and contract of programs conducted per sector



Although the potential for the cogeneration market in Tunisia's industrial sector was estimated at 606 MW by ANME, only 77 MW were installed by the end of 2015 - of which 65 MW were installed in the period 2011-2015. The graph below shows the progress of the cogeneration market in the industrial sector between 2010 and 2015.

Figure 30: Cogeneration installed capacity



Employment in Energy Efficiency

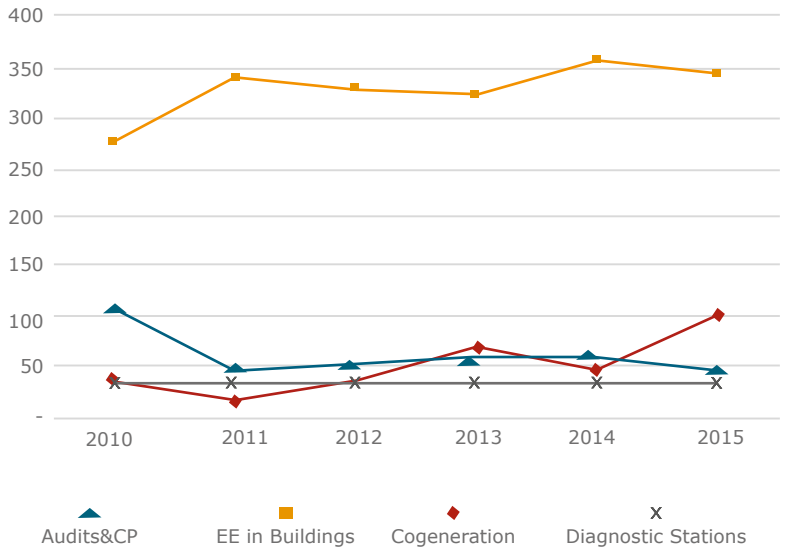
In 2016 Alcor and GWS on behalf of GIZ conducted a survey for the number of direct jobs created in EE and RE in Tunisia during 2015. Direct employment created by EE was calculated on the basis of direct jobs creation in the different areas, sectors, industries, and comprises of permanent jobs (EP) and intermittent employment (EI). EE jobs are included in markets for energy audits, installation and construction, cogeneration, diagnostic stations, and production of EE technologies and equipment. These markets cross numerous sectors including: testing and R&D, manufacturing, engineering, supply and installation, as well as operation and maintenance. The study found that in 2015, the EE projects/ initiatives created 823 jobs in Tunisia, as seen in Table 34

Table 34: Jobs created in the EE sector

Energy Efficiency	Testing	Development and Study	Manufacturing	Supply & Installation	Operation& Maintenance	Total
Audits and CP	25	47	-	-	-	47
Energy Efficiency in buildings	-	6	99	242	-	372
Cogeneration	-	0.5	-	41	63	105
Diagnostics stations	-	-	-	-	35	35
EE equipment	5	-	-	260	-	265
Total	30	53	99	543	98	823

Figure 31 shows the development of jobs created by energy efficiency between 2010 – 2015. Most EE jobs were focused in the buildings and energy efficiency equipment sectors. For example, almost 66% of total EE jobs created in 2015 were in supply and installation activities, mostly related to installation of thermal insulation. For the EE building sector, there has been a generally small steady increase in job creation. The only sector that witnessed a significant increase in energy efficiency in this period is cogeneration, where the amount of jobs created more than doubled in 2015.

Figure 31: Jobs created by EE between 2010 and 2015



Employment in Energy Efficiency

Tunisia's INDC commitment is a 41% reduction in carbon intensity by 2030 from the 2010 levels. To achieve this ambitious goal, Tunisia needs a large amount of investment in its energy and energy efficiency sectors. This investment is estimated at 17.5 billion US$, of which 40% or 7 billion US$ is earmarked for energy efficiency. The Alcor and GWS report projects that a renewed focus on EE and RE policy and finance can lead to an additional 25,000 jobs in Tunisia by 2030. For EE jobs, the projected main employer is the construction sector, specifically in thermal installation. This economically positive projection depends on a continued commitment to creating and enforcing EE policy, securing stable financial support for EE initiatives, and engaging with the private sector.

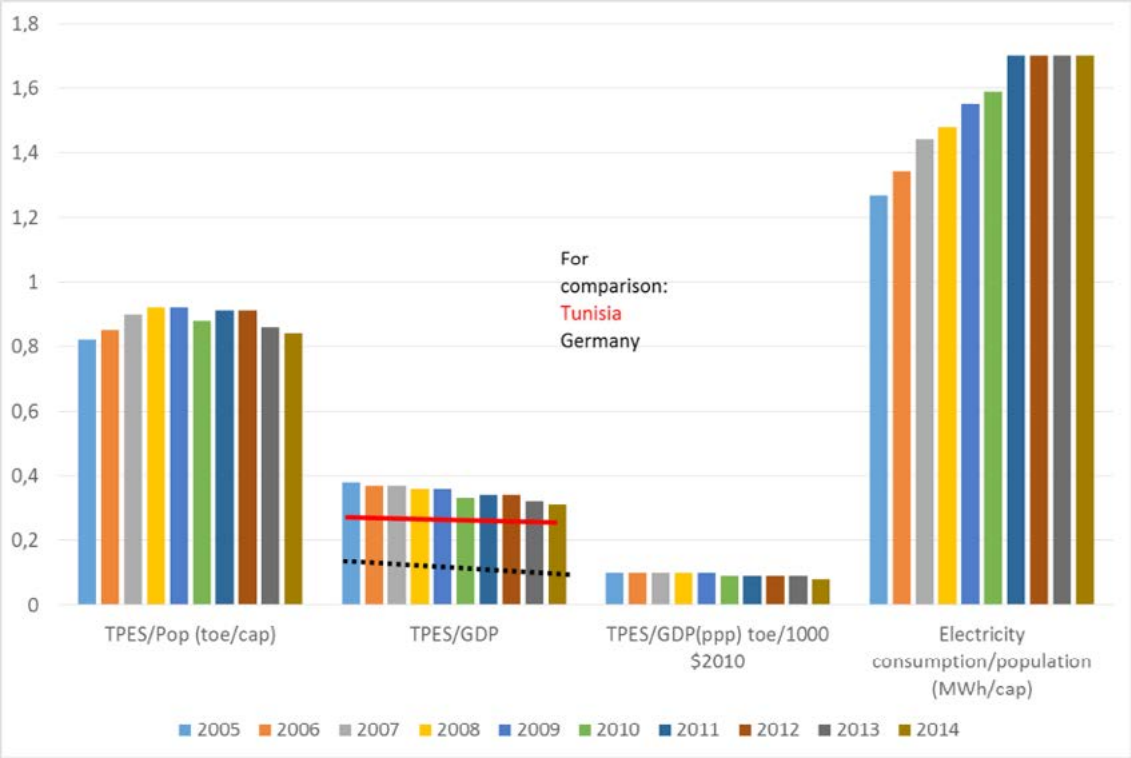
Case Study

Socio-Economic Impact of EE in the Arab Region: Job Creation in Energy Efficiency in Egypt

1 Energy Efficiency in Egypt current situation

The Egyptian energy situation leaves room for energy efficiency improvement. With a growing population, Egypt finds itself facing growing energy demand. Since 2005, energy supply therefore had to grow from 61.48 Mtoe to 78.26 Mtoe in 2012, stagnating at this level due to slower growth. While energy productivity actually slightly increased over the last years, it is still lower than other countries in the region and OECD countries.

Figure 32: Efficiency indicators for Egypt (physical units per cap or per $2010)



Source: IEA Indicators

The electricity situation is even tighter. Electricity consumption per capita increased from 1.27 MWh/cap to 1.7 MWh per cap, yielding an increase in electricity consumption by more than 60% between 2005 and 2014 (all data from IEA).

The National Energy Efficiency Action Plan has been adopted (2012-2015) and aims for an increase in efficiency by 5% (RCREE 2012). Currently few incentives are available, apart from a mandatory EE code for residential, commercial and governmental buildings. Labels have been adopted for household appliances, such as washers, freezers, air conditioners, water heaters and CFLs.

By 2013 12 million CFLs have been distributed according to the following scheme. 11.4 million CFL lamps have been sold through the distribution companies at half price or by instalments and with a guarantee of 18 months lifetime. With a population of more than 89 million people, this does not yet cover one lamp per household. At the end of Egypt's NEEAP (2012 – 2015) an additional 13 million LED lightbulbs were also distributed to the residential sector.

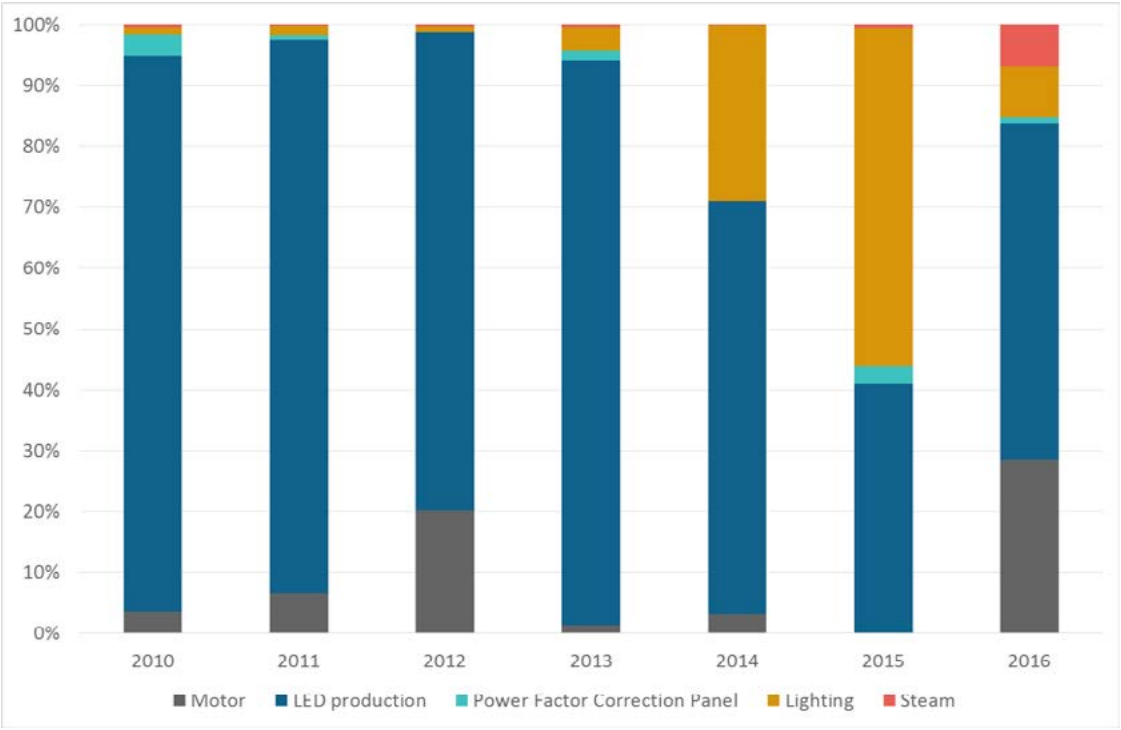
Street lights consume almost 5% of Egypt's total electricity consumption. In order to decrease the electricity bill for communities, an energy efficiency program for street lights was put into effect. However, little data exists regarding the success of the program. Finally, it is worth mentioning that Egypt has prepared the final draft of its second national energy efficiency action plan (NEEAP 2018 -2020).

2 Employment from current activities

Increasing energy efficiency has a positive effect on employment through various channels. Firstly, if energy efficiency technologies are domestically produced, additional demand for these goods yields additional employment throughout the domestic value chain. Secondly, audits and consultant activities have a positive job impact on the service sector. And thirdly, money saved from energy savings can be spent for other consumption purposes, which, if satisfied by domestic production increases GDP and jobs even further. Thus, energy efficiency has a threefold dividend.

In the study on "The Socio-Economic impacts of Renewable Energy and Energy Efficiency in Egypt: Local Value, Employment and Capacity Building", commissioned by RCREEE in spring 2017, these effects were analyzed in great detail. The results showed that employment from energy efficiency is dominated by the production of efficient lightbulbs (Figure 2). Other areas of efficiency are still rather underdeveloped. It is worth noting that the data situation for efficiency was very difficult for the study team and hence the figures presented here can be considered as a very conservative estimate.

Figure 33: Relative employment shares - EE (Percentage)



Source: The Socio-Economic impacts of Renewable Energy and Energy Efficiency in Egypt: Local Value, Employment and Capacity Building

The results of the study showed that at the end of 2016 more than 9,100 people in Egypt were employed in jobs related to renewable energy and energy efficiency. The majority of these jobs were concentrated in the renewable energy sector. Nonetheless, the energy efficiency sector contributed to the creation of almost 1000 direct and indirect jobs. Of this number, the analysis of the available data showed that more than 560 people are working in the energy efficient lamps manufacturing industries, consulting companies or installation of efficient air-conditioning.

Nevertheless, since the Egyptian construction sector employs more than 1.2 million people, the rapid growth of this sector could lead to a significant increase in energy efficiency jobs. However, data on energetic building improvement are scarce. If we compare to the volume of additional energy efficiency jobs in Tunisia, we find that more than 500 jobs were in companies specialized in building insulation. Further impacts would arise from up-stream industries producing double glazed windows, insulation material etc. for Egypt, with the much larger housing market, these numbers can easily be 5 times as high.

3 Perspectives

Household energy efficiency should be at the forefront of Egypt's efficiency strategy, because it decreases the energy bills and may enhance the awareness for other environmental and health issues such as water saving and avoiding waste.

However, efforts are necessary in all sectors. Public buildings can be a good showcase for energy efficiency measure in this sector, industry could improve processes towards more energy efficiency. The impact on the job market from these activities depends on the degree to which appliances and building materials are domestically produced and to which services such as audits, energy management programs, or energy consulting services can be provided by Egyptian companies. Drawing from results from a similar analysis in Tunisia shows, that additional efficiency in buildings yields close to 400 more jobs. Given the larger market in Egypt, this number can easily be a multiple thereof and be close to 3000 jobs.

If we account for solar water heaters as an efficiency technology, because it replaces electric water heaters, the employment impact becomes even larger. Manufacturing and installation can lead to more than 2000 additional jobs per year.

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List of Abbreviations

ADEREE	National Agency for the Development of Renewable Energy and Energy Efficiency
ADME	Air Conditioning
AFED	Arab Forum for Environment and Development
AFD	Agence Française de Développement
AFEX	Arab Future Energy Index
AMCE	Arab Ministerial Council for Electricity
APRUE	Algerian National Agency for the Promotion and Rationalization of Use of Energy
ANME	National Agency for Energy Conservation of Tunisia
AUE	Arab Union of Electricity
CEDARE	Center For Environment & Development for the Arab Region & Europe
CEMP	Certified Energy Management Professional
CFL	Compact Fluorescent Lamp
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CREG	Commission Algérien de Régulation de l'Electricité et du Gaz (CREG)
DEWA	Dubai Electricity & Water Authority
DIES	Dubai Integrated Energy Strategy
DSM	Demand Side Management
EE	Energy Efficiency
ERC	Electricity Regulatory Commission
EDL	Electricité du Liban
EGYPTERA	Egyptian Electric Utility and Consumer Protection Agency
EIA	US Energy Information Agency
EIB	European Investment Bank
ESMA	Emirates Authority for Standardization and Meteorology
EU	European Union
EWA	Bahrain Electricity & water Authority
EPC	Energy Performance Contracting
ESCO	Energy Service Company
GCC	Gulf Cooperation Council
GDP	Gross domestic product
GHG	Greenhouse gas(ses)
GE	General Electric
GEF	Global Environment Facility
GEFF	Green Environment Financing Facility
GORD	Gulf Organization for Research and Development
GSAS	GSAS Global Sustainability Assessment System
HBRC	Egypt Housing and Building Research Center
IEA	International Energy Agency
IMF	International Monetary Fund
JREEEF	Jordan Renewable Energy and Energy Efficiency Fund
IRENA	International Renewable Energy Agency
KACST	King Abdulaziz City for Science and Technology
KAUST	King Abdullah University for Science & Technology
KAHRAMAA	Qatar General Electricity & Water Corporation
KISR	Kuwait Institute for Scientific Research
kWh	Kilowatt hour
LCEC	Lebanese Center for Energy Conservation
LED	Light Emitting Diode
LEED	Leadership in Energy and Environmental Design
LDV	Light Duty Vehicle
LNG	Liquefied Natural Gas
MEPS	Minimum Energy Performance Standard
NDC	Nationally Determined Contribution
NEEAP	National Energy Efficiency Action Plan
NEEP	National Energy Efficiency Program
NEERA	National Energy Efficiency and Renewable Energy Action
NERC	National Energy Research Centre
NOGA	National Oil and Gas Authority
NREA	New and Renewable Energy Authority
NOx	Nitrogen Oxides
OECD	Organization for Economic Co-operation and Development
PEA	Palestinian Energy Authority
PEC	Palestinian Energy and Environment Research Centre
PM	Particulate Matter
QEERI	Qatar Science & Technology Park
RCREEE	Regional Center for Renewable Energy and Energy Efficiency
RE	Renewable energy
SDG	Sustainable Development Goals
SEEP	Saudi Energy Efficiency Program
SO_2	Sulfur Dioxide
SO_4	Sulfate
SWH	Solar water heater
Toe	Tonne of oil equivalent
ToU	Time of Use
UAE	United Arab Emirates
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNIDO	United Nation Industrial Development Organization
US$	United States Dollar
VAT	Value Added Tax
WHO	World Health Organization

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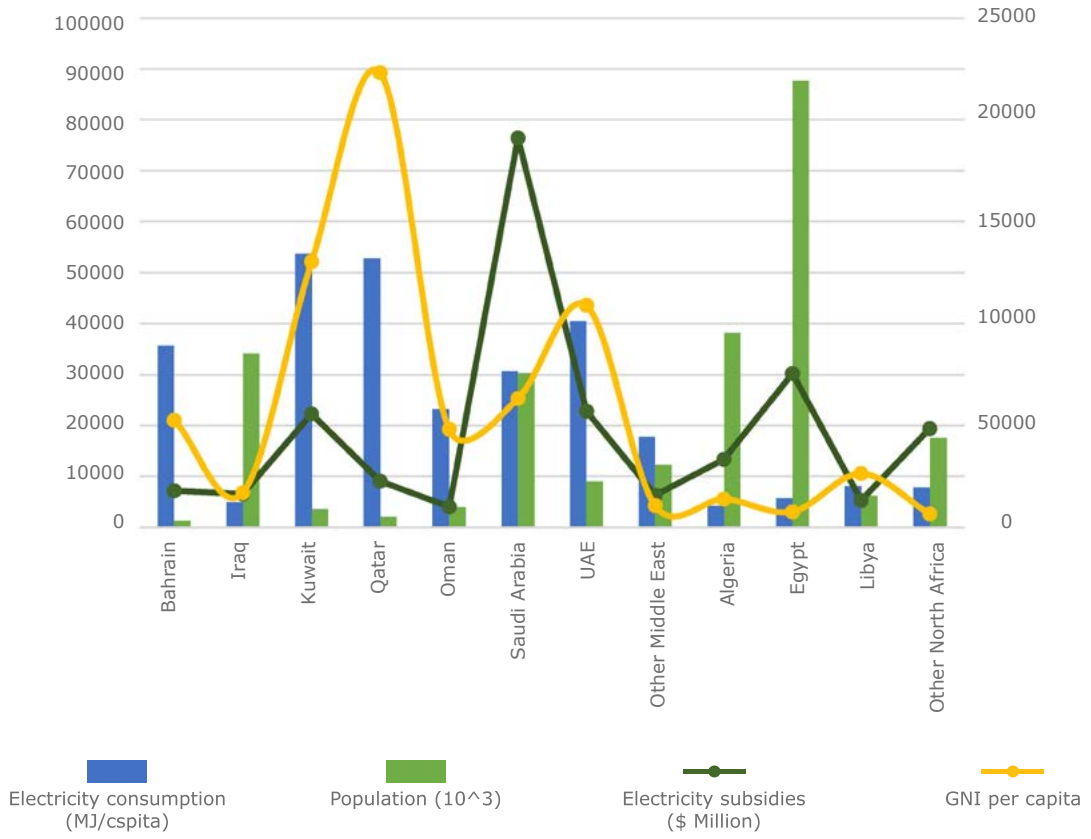
Annex

Annex 1



Source: World Bank, IMF and AUE

Annex 2

Stage	Date	CO	HC	HC+NOx	NOx	PM	PN
		g/km					value/km
Positive Ignition (Gasoline)							
Euro 1	1992.07	2.72 (3.16)	-	0.97 (1.13)	-	-	-
Euro 2	1996.01	2.2	-	0.5	-	-	-
Euro 3	2000.01	2.3	0.2	-	0.15	-	-
Euro 4	2005.01	1	0.1	-	0.08	-	-
Euro 5	2009.09	1	0.1	-	0.06	0.005	-
Euro 6	2014.09	1	0.1	-	0.06	0.005	6.0×1011
Compression Ignition (Diesel)							
Euro 1	1992.07	2.72 (3.16)	-	0.97 (1.13)	-	0.14 (0.18)	-
Euro 2, IDI	1996.01	1	-	0.7	-	0.08	-
Euro 2, DI	1996.01	1	-	0.9	-	0.1	-
Euro 3	2000.01	0.64	-	0.56	0.5	0.05	-
Euro 4	2005.01	0.5	-	0.3	0.25	0.025	-
Euro 5	2009.09	0.5	-	0.23	0.18	0.005	-
Euro 5	2011.09	0.5	-	0.23	0.18	0.005	6.0×1011
Euro 6	2014.09	0.5	-	0.17	0.08	0.005	6.0×1011

Source: Dieselnet

Annex 3

The structure of AFEX Energy Efficiency is based on three main components to derive a final index score. It consists of 30 quantitative and qualitative indicators, which combine to provide higher-level results for 10 factors. The factors are aggregated to the highest level, supplying results for 4 categories. When the results of all categories for all countries are combined, the final index result is achieved.

AFEX Energy Efficiency uses the OECD methodology for constructing composite indicators (OECD, 2008). The technical parts of the index construction are performed with guidance from the Joint Research Center's 10th JRC Annual Seminar on Composite Indicators.*

Data are organized in accordance with the established conceptual framework. Each indicator is assigned a desired direction depending on its nature and value, where '1' indicates a higher score is better and '-1' indicates a lower score is better. The indicators are assigned weights depending on their importance in relation to each other under the same category. The weights are then re-scaled to unity sum. Once data are organized, necessary statistical descriptors such as missing values, minimum, maximum, mean, standard deviation, skewness and kurtosis are calculated for each indicator.

In order to negotiate the direction and to be able to aggregate the data to develop index scoring, the 'min-max method' is used for indicator normalization. The directions and weights of the individual indicators are taken into account during this normalization. The following formula is used for normalization:

$$\text{new value} = \frac{(\text{old value} - \text{min})}{(\text{max} - \text{min}) * \text{direction}} + 0.5*(1 - \text{direction})$$

where:

new value is the indicator's resultant value after normalization;

old value is the indicator's value supplied by measurement, statistical data, survey or other collection technique;

min is the minimum value observed in the 17-country group for the indicator;

max is the maximum value observed in the 17-country group for the indicator;

direction is the value of either 1 or -1 that indicates the direction of scoring for the indicator.

The normalized values for each indicator are combined to provide scores for each factor, and factors are combined to score each category. Results for the four categories are combined to develop final index scores and ranks based on the min-max method.

Ranks for individual indicators are also calculated, but not displayed in the report. Ranks have proven to be useful while interpreting the results and to argue why one country has performed better than another within a category. When the raw data are normalized using ranks, the directions of the indicators are also taken into account.

The arithmetic mean, applying variable weight to each normalized indicator value, is used to develop the rank and the performance of each country for the given set of indicators. Weights are assigned to each indicator, summing to unity for each category. The assignment is based on the relative impact each indicator is perceived to have upon the category being measured, and is based on the experience of RCREEE's regional experts.

* The guide is available at **http://ipsc.jrc.ec.europa.eu/index.php?id=65**

Hydro Power Building (7th Floor)
Block 11 - Piece 15, Melsa District
Ard El Golf, Nasr City, Cairo, Egypt
Telephone: +20 2 2415 4755
Fax: +20 2 2415 4661

مبنى المحطات المائية (الدور ٧)
بلوك ١١ – قطعة ١٥، عمارات ملسا
أرض الجولف، مدينة نصر، القاهرة، مصر
الهاتف: ٤٧٥٥ ٢٤١٥ ٢ ٢٠+
الفاكس: ٤٦٦١ ٢٤١٥ ٢ ٢٠+

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