Arab Future™ Energy Index

AFEX 2013

Energy Efficiency

RCREEE
Regional Center for Renewable Energy and Energy Efficiency
المركز الإقليمي للطاقة المتجددة وكفاءة الطاقة

Index Report

Arab Future Energy Index™(AFEX) Energy Efficiency

2013

Regional Center for Renewable Energy and Energy Efficiency (RCREEE)

RCREEE

Regional Center for Renewable Energy and Energy Efficiency

المركز الإقليمي للطاقة المتجددة وكفاءة الطاقة

The Arab sustainable energy trend starts now

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AFEX 2013

Energy Efficiency

Forward

On behalf of our team across 13 Arab nations, it's a great pleasure to present to you the first index dedicated to monitoring and analyzing sustainable energy transition in the Arab region, the Arab Future Energy Index™ (AFEX). Launching its first issue this year, the initiative represents only the start of a long and challenging path to provide the Arab region with accurate, reliable, and comparable information regarding their renewable energy and energy efficiency capabilities.

His Excellency Sheikh Nawaf Bin Ibrahim Bin Hamed Al Khalifa
Chairman of the Board of Trustees
RCREEE

AFEX is a useful tool for our policy makers to help them shape national energy long term strategies, formulate laws and regulations, develop institutional capacity, enrich local scientific research, and attract investments. The index also helps local and international investors to know more about Arab states' readiness in the field.

Since our region carries diversified and special market characteristics for each country, collecting data and finding mutual benchmarking base was a challenging goal. RCREEE team collected AFEX data from both international and local resources to guarantee maximum accuracy and transparency. We hope that this initiative will help our member states in their efforts toward sustainable energy transitions through quality tracking of the progress made and challenges yet to be tackled.

Sincerely,

Nawaf Al Khalifa
Chairman of the Board of Trustees, RCREEE

About RCREEE

The Regional Center for Renewable Energy and Energy Efficiency (RCREEE) is an independent not-for-profit regional organization 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.

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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 dimensions. Countries are ranked under more than 20 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.

This year, AFEX ranks 13 Arab states and provides tailored recommendations for member states to help improve their sustainable energy competitiveness.
AFEX inaugural launch was in 2013 and will be issued annually consisting of two components: AFEX Renewable Energy and AFEX Energy Efficiency. 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.

For more information, please visit afex.rcreee.org.

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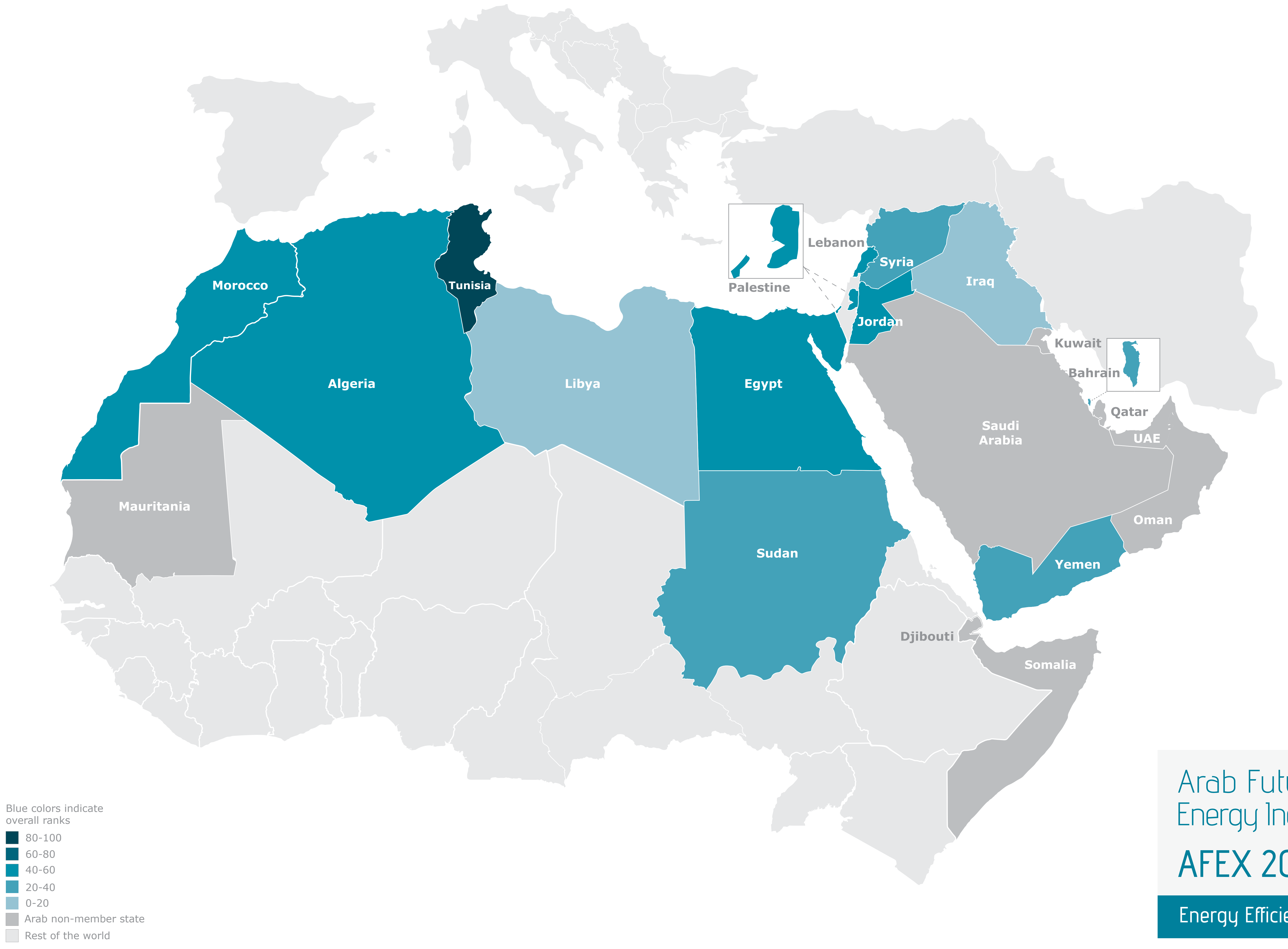


Arab Future™ Energy Index

AFEX 2013

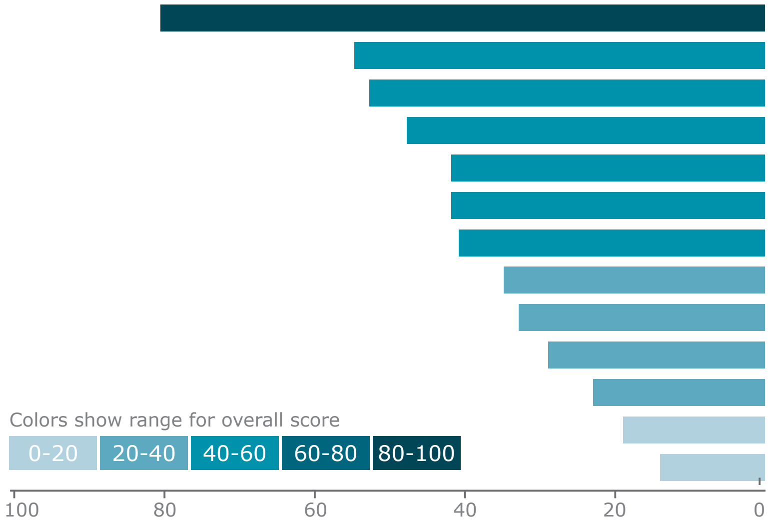
Energy Efficiency

Key Findings

AFEX Energy Efficiency Results

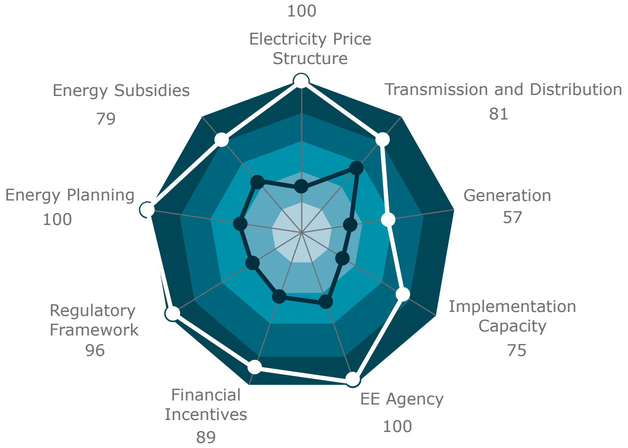
AFEX Energy Efficiency 2013 provides an assessment of countries' progress in energy efficiency according to four evaluation categories: Energy Pricing, Policy Framework, Institutional Capacity and Utility. Under these categories, countries are assessed by 24 quantitative and qualitative indicators

Figure 1: AFEX Energy Efficiency Results



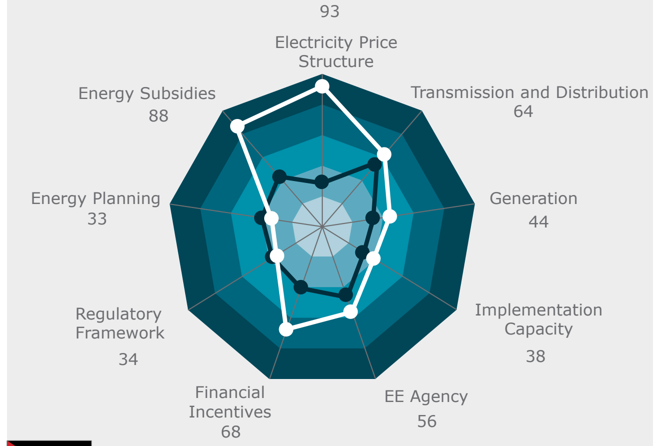
	Final Score	Energy Pricing	Policy Framework	Institutional Capacity	Utility
Tunisia	81	83	95	79	65
Morocco	55	89	44	36	51
Jordan	53	51	64	44	53
Palestine	48	81	31	55	27
Algeria	42	33	62	33	41
Lebanon	42	36	48	41	44
Egypt	41	28	49	28	57
Syria	35	28	42	32	39
Bahrain	33	17	25	44	44
Sudan	29	44	22	14	35
Yemen	23	39	14	14	25
Libya	19	17	12	12	35
Iraq	14	10	18	16	13

Tunisia 81

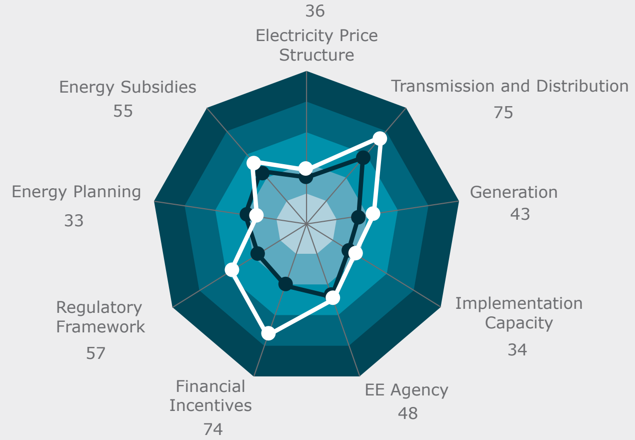


Among the 13 countries, Tunisia stands out with the most comprehensive policy framework for energy efficiency improvement. The Tunisian policy framework consists of a wide range of measures including regulatory, fiscal and financial instruments, covering electricity and other forms of energy. It impacts all sectors of the economy: residential, tertiary, industrial, utility, lighting, buildings and appliances. Tunisia has demonstrated clear commitment for a continuous improvement by periodically monitoring, reviewing, adjusting and tightening energy efficiency requirements. The key to its success is a strong institutional body consisting of strategic leadership, dedicated resources and competent staff.

Morocco 55

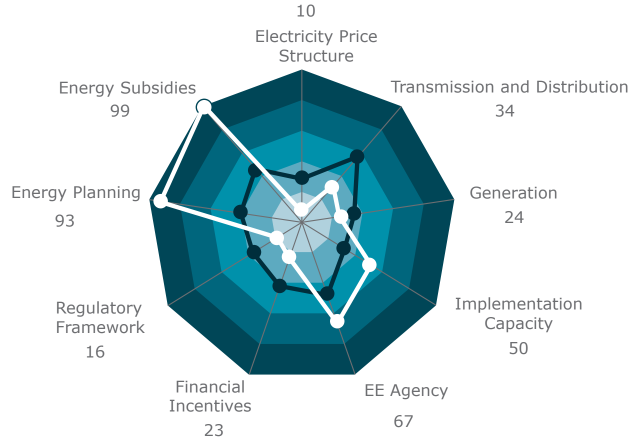


Jordan 53



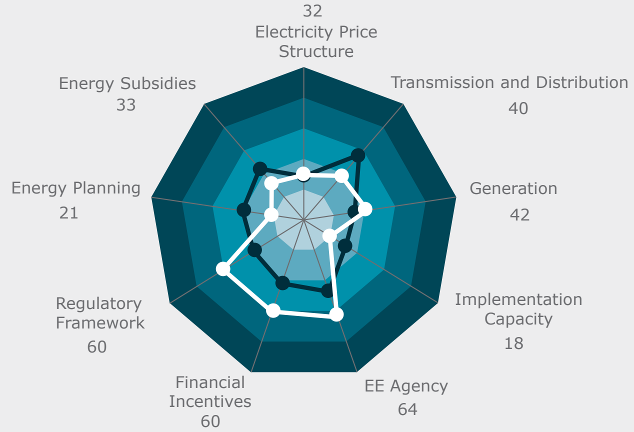
Morocco and Jordan are almost tied for the second spot. Morocco performs better due to market-based electricity prices. This allows Morocco to focus on introducing progressive energy efficiency policies. Jordan has made substantial progress in the past year in improving its regulatory framework: it adopted the Law on Renewable Energy and Energy Efficiency, implementation bylaws, a statutory obligation to install solar water heaters in new buildings and is currently finalizing its first national energy efficiency action plan. Jordan should now concentrate efforts on strengthening its implementation capacity in order to properly capitalize on newly introduced energy efficiency policies.

Palestine 48

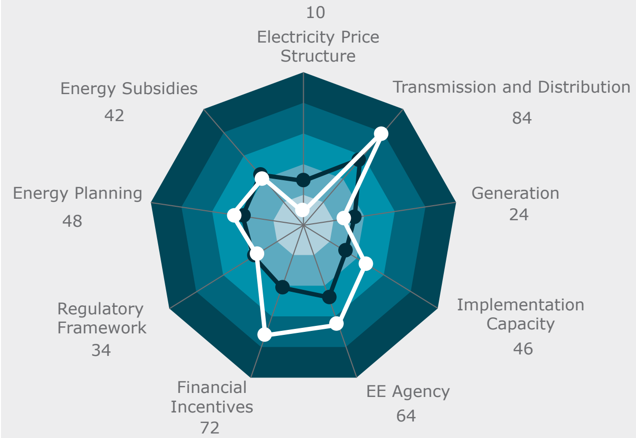


Palestine is next in the index ranking. Palestine, with the highest electricity prices in the region, has the highest rate of solar water heater diffusion. Conditions in Palestine are conducive to adoption of energy efficiency measures, but at the same time challenges exist. Palestine has made a good start by adopting its first national energy efficiency action plan and by establishing a revolving fund for financing energy efficiency projects. It should continue developing its regulatory framework and further explore options to overcome the challenge of financing energy efficiency projects.

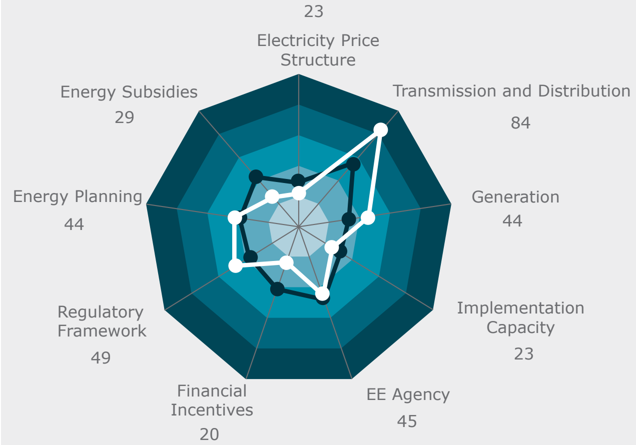
Algeria 42



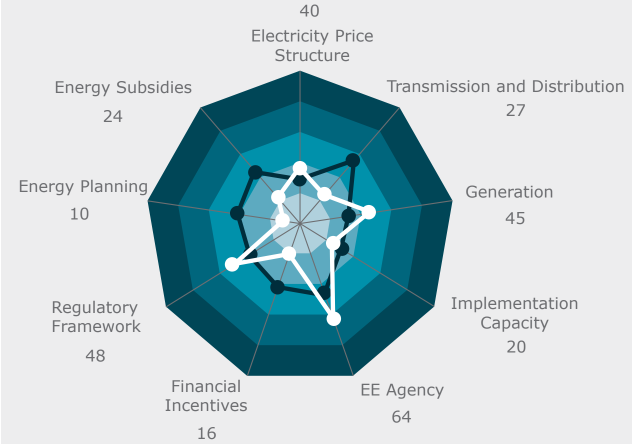
Lebanon 42



Egypt 41

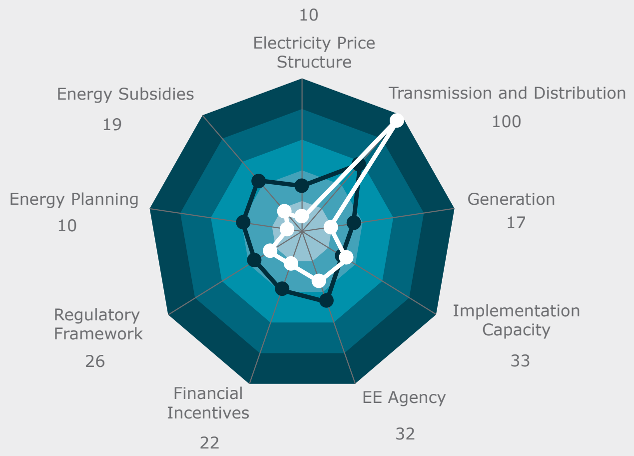


Syria 35



Average / Country

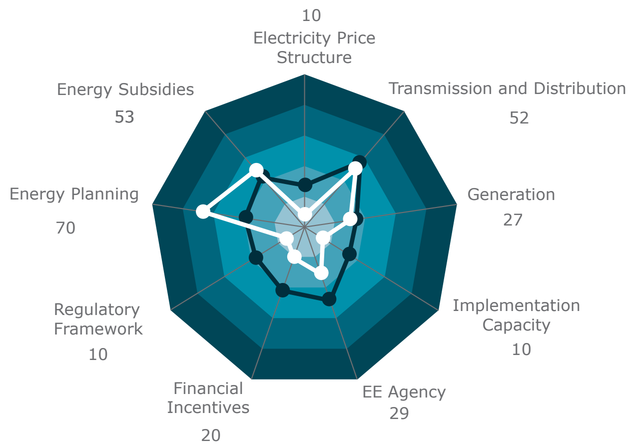
Bahrain 33



The mid-ranking countries – Algeria, Lebanon, Egypt, Syria and Bahrain – have similar energy efficiency policy frameworks, but are characterized by heavily subsidized electricity prices. These countries appear to be facing greater challenges in enforcement and compliance, thus the focus should be on smart reform of their energy pricing systems and introducing more cost-reflective tariffs.

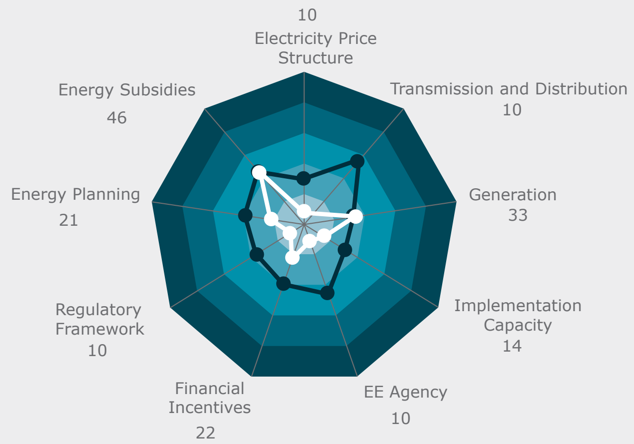
Lebanon has an active dedicated energy efficiency body and has introduced financial schemes that have proven to be functional. However, its current situation includes uncoordinated actions among various stakeholders and a subsidized energy pricing structure. These factors present challenges to more progressive development in energy efficiency.

Sudan 29

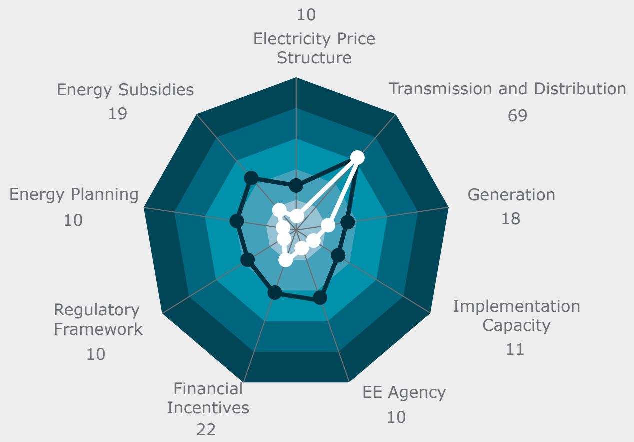


Sudan is one of the early adopters of a national energy efficiency action plan, which contains a number of important measures for improvement of energy efficiency in the utility sector. It should now concentrate on implementing these measures and building a base for proper monitoring and evaluation.

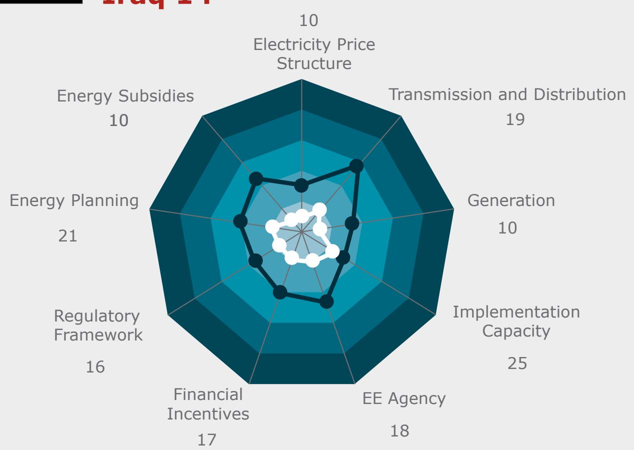
Yemen 23



Libya 19



Iraq 14

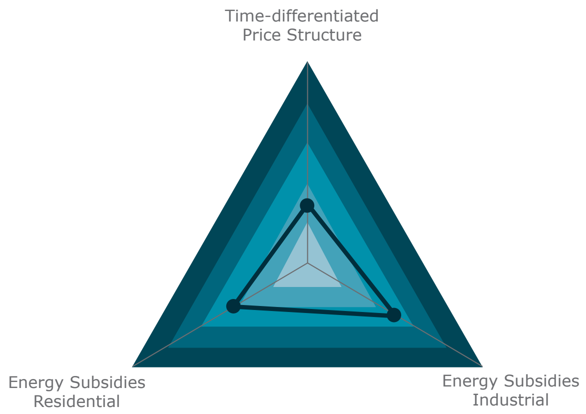


The lagging three countries – Yemen, Libya and Iraq – lack energy efficiency policy framework, have weaker institutional capacity, and have higher losses in their power generation, transmission and distribution networks. These countries need to focus on prioritizing, energy planning and mobilizing efforts as they begin to introduce energy efficiency measures.

Average Country

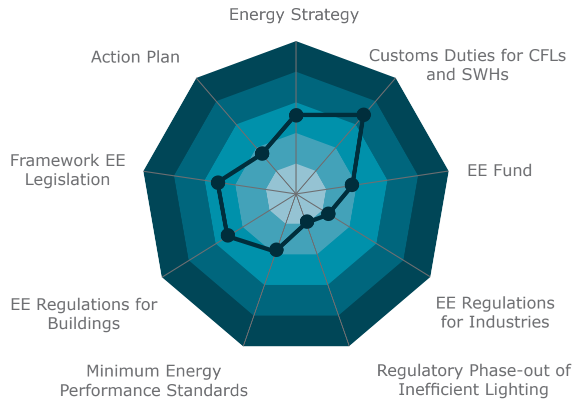
Energy Pricing

Although all barriers play a role, heavily subsidized energy prices deserve special attention from policymakers. Unlike other barriers, energy subsidies constitute an 'active' obstacle to energy efficiency, the presence of which will always undermine and impede the effectiveness of efforts to improve energy efficiency. When energy prices are subsidized, governments must expand more resources in their efforts to promote energy efficiency.



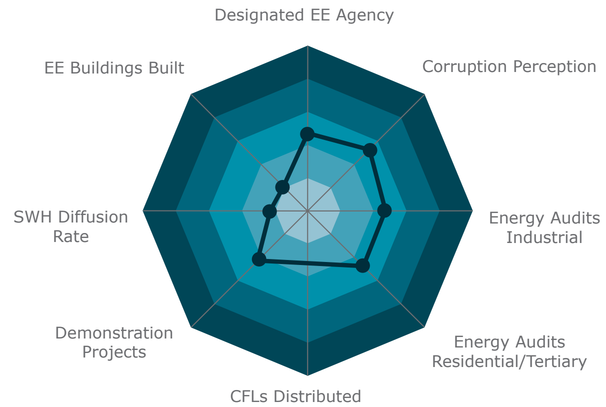
Policy Framework

AFEX Energy Efficiency includes countries with wide-ranging levels of progress in their policy frameworks, from advanced to almost non-existent. The assessment reveals a lack of coherence between various policies; for example almost all countries have a policy of energy efficient lighting distribution at reduced costs, whereas the customs duty for these products remains high. These two policies do not complement each other. Generally speaking; countries need to consider the sum of the results of their chosen policies. The industrial sector in the region appears to be the least regulated. Of 13 countries, only three have legislation encouraging energy efficiency in the industrial sector, and only one of these three has an effective energy efficiency regulatory framework. The industrial sector presents ample opportunities for energy efficiency improvements, constitutes relatively smaller numbers of customers and represents a substantial part of the economy. It appears wise to focus more attention on this sector.



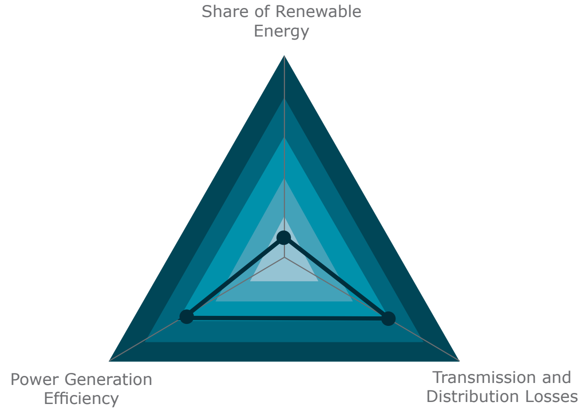
Institutional Capacity

Institutional capacity in the region as a whole is rather weak, with the exception of Tunisia. Almost all countries lack implementation, seriously jeopardizing the effectiveness of energy efficiency policies. Tunisia's relatively successful implementation of energy efficiency measures is mostly attributed to its strong, dedicated energy efficiency agency. Almost half of the countries have developed national energy efficiency action plans and have adopted energy efficiency targets; however, not all have sufficient resources to support meeting these targets. Countries need to allocate sufficient resources to ensure an effective implementation and to build a strong institutional capacity.



Utility

All countries have massive untapped potential for energy efficiency in the utility sector. The efficiency in the power generation, transmission and distribution networks remains relatively low compared to the European average. Countries also have substantial unutilized renewable energy resources that could effectively be used to increase energy security and improve environmental performance. Countries should follow the examples of Palestine and Sudan by setting clear goals to improve energy efficiency in the utility sector.



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Abbreviations

ADEREE	Agence Nationale pour le Développement des Energies Renouvelables et de l'Efficacité Energétique
AFED	Arab Forum for Environment and Development
ANME	Agence Nationale pour la Maîtrise de l'Energie
APRUE	L'Agence Nationale pour la Promotion et la Rationalisation de l'Utilisation de l'Energie
AUE	Arab Union of Electricity
boe	barrel of oil equivalent
CFL	compact fluorescent lamp
CO_2	carbon dioxide
CPI	Corruption Perception Index
DA	Algerian dinar
EE	energy efficiency
ERA	Electricity Regulatory Authority
ESCO	energy service company
EU	European Union
EUR	Eurozone euro
Gcal	gigacalorie
GDP	gross domestic product
GEF	Global Environment Facility
GHG	greenhouse gas(ses)
GWh	gigawatt-hour
IEA	International Energy Agency
km	kilometre
ktoe	kilotonne of oil equivalent
kWh	kilowatt-hour
LCEC	Lebanese Center for Energy Conservation
LED	light emitting diode
MENA	Middle East and North Africa
MEPS	minimum energy performance standard
MT	megatonne
MWh	megawatt-hour
m^2	square metre
NEEAP	national energy efficiency action plan
NERC	National Energy Research Centre
OAPEC	Organization of Arab Petroleum Exporting Countries
OECD	Organization for Economic Co-operation and Development
PEA	Palestinian Energy Authority
PPP	purchasing power parity
RCREEE	Regional Center for Renewable Energy and Energy Efficiency
RE	renewable energy
REAOL	Renewable Energy Authority of Libya
SWH	solar water heater
TND	Tunisian dinar
toe	tonne of oil equivalent
TWh	terawatt-hour
USD	United States dollar

1. Introduction

1.1 About AFEX Energy Efficiency

The Arab Future Energy Index™ (AFEX) Energy Efficiency is a policy assessment and benchmark tool that aims to provide a comprehensive assessment of the current state of energy efficiency (EE) and quality of EE governance in the Arab region.

AFEX Energy Efficiency has been developed to:

- Provide systematic comprehensive assessment of EE progress in RCREEE member states
- Benchmark countries' performance in order to provide additional stimulus to strive towards EE
- Effectively communicate the assessment results
- Identify areas for possible intervention at the regional level to support EE efforts.

1.2 Scope of Assessment

AFEX Energy Efficiency assesses four major areas:

1. The current structure of energy pricing
2. States' efforts and level of commitment in overcoming market, social and political barriers to EE through strategies, policies and specific action plans
3. Institutional capacity to design, implement and evaluate EE policies
4. Efficiency of utility sector, including power generation efficiency, and efficiency in power transmission and distribution networks.

1.3 Methodology

AFEX Energy Efficiency is constructed in accordance with the OECD methodology for constructing composite indicators (OECD, 2008). Detailed description of methodology is presented in Annex A. The conceptual framework of AFEX Energy Efficiency is presented in Table 1 below. It consists of four evaluation categories relating to the index's objectives: (1) Energy Pricing; (2) Policy Framework; (3) Institutional Capacity; and (4) Utility.

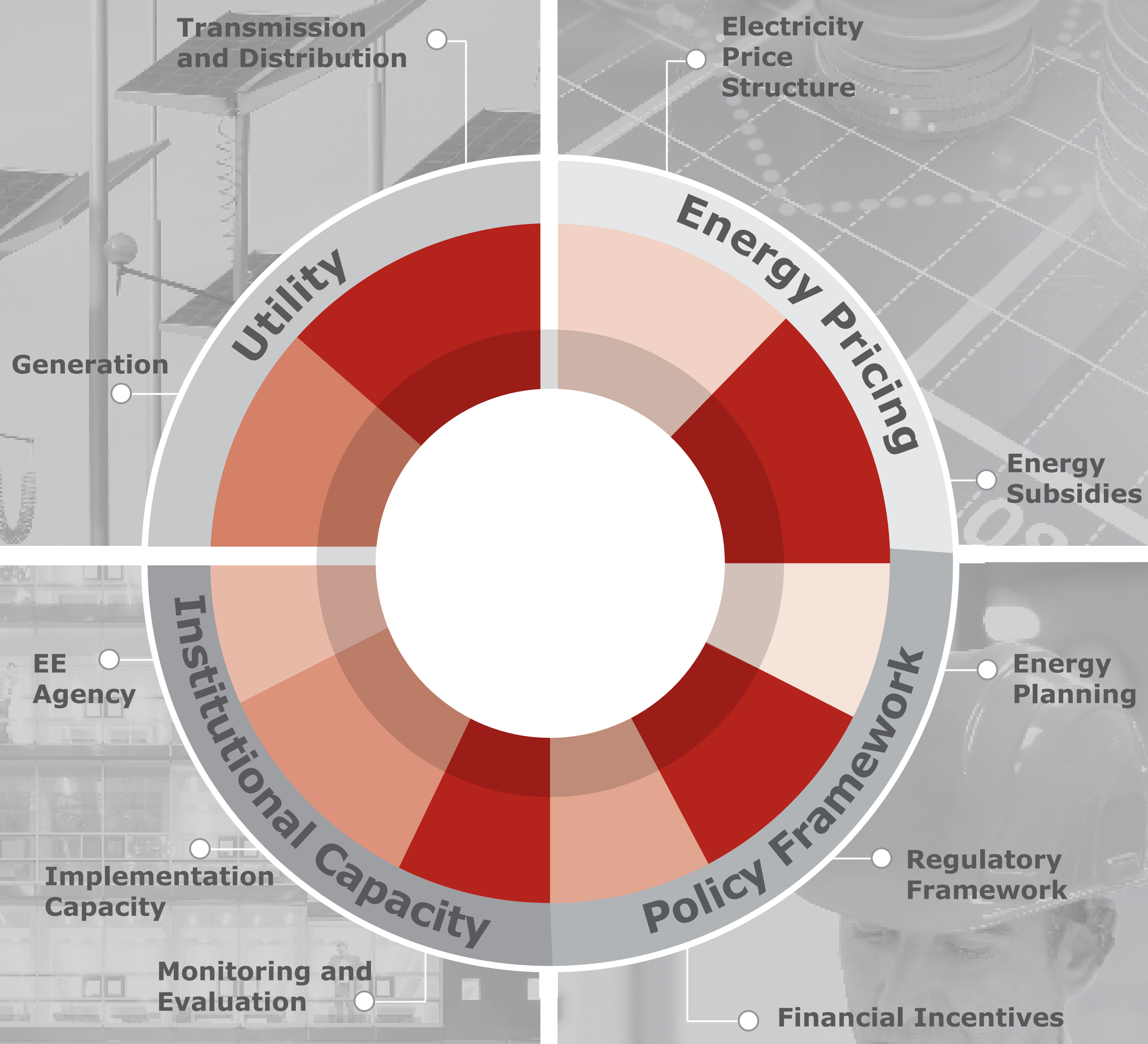
Table 1: AFEX Energy Efficiency factors and indicators

Category	Factors	Indicator	Score/Measuring Unit
Energy Pricing	Electricity price structure	Time of use price structure	Number of segments
		Price incentives for residential customers	
	Energy subsidies	Subsidy amount in residential sector	% (benchmarked to Palestinian retail prices for electricity)
		Subsidy amount in industrial sector	% (benchmarked to Palestinian retail prices for electricity)
Policy Framework	Energy planning	Energy strategy with long term EE objectives	Officially adopted (1); nonexistent (0)
		Action plan with quantitative time bound EE indicative targets (macro; residential/tertiary; industrial, utility)	
	Regulatory framework	Framework legislation for EE measures	Adopted (1); draft prepared (0.5); nonexistent (0)
		EE regulations for buildings	Mandatory (1); voluntary/under preparation (0.5); non-existent (0) Statutory obligation to install solar water heaters in new buildings (0.5)
		Minimum energy performance standards with labeling schemes for household appliances	
		Regulatory phase-out of inefficient lighting technology	Existent (1); non-existent (0)
		EE regulations for industries	Number of policy measures
	Financial incentives	EE Fund	Established by law (0.5); sources of financing are clear (0.5); disbursement procedure is clear (0.5)
		Internal tax benefits	Number of tax benefits
		Customs duty for CFLs and SWHs	%
Institutional Capacity	EE Agency	Designated EE agency	Expert assessment from 0 to 10 based on: presence of designated EE agency; adequacy of technical and human resources; capacity to formulate and implement EE policies
	Implementation capacity	Number of EE building built	% of new building stock
		Solar water heater diffusion rate	m2 of panels per 1,000 inhabitants
		Number of demonstration projects	Expert assessment from 0 to 10 based on number of demonstration projects; market size of construction industry
		Number of CFLs distributed	% of residential customers
		Number of energy audits conducted in residential/tertiary sectors	Expert assessment from 0 to 10
		Number of energy audits conducted in industrial sector	Expert assessment from 0 to 10
		Corruption Perception Index	CPI scores
	Monitoring and Evaluation		
Utility	Generation	Power generation efficiency	%
		Share of renewable energy in generation mix	% (MW installed capacity)
	Transmission and distribution	Transmission and distribution losses	%

Three areas – price incentives for residential customers, internal tax benefits and monitoring and evaluation – are highlighted above in grey. These were not assessed in the AFEX Energy Efficiency 2013 results due to lack of data, but will be included in next edition.

The fourth category, Utility, assesses efficiency of power generation and losses in transmission and distribution networks.

The first category, Energy Pricing, assesses the factors that are important to promote the market for EE services, but do not necessarily require compliance and enforcement mechanisms. These factors include introducing a time-differentiated price structure and the amount of fossil fuel subsidies.



The third category, Institutional Capacity, measures capability of the states to properly design and deliver effective EE policies.

The second category, Policy Framework, relates to the policy measures that have been identified as necessary to stimulate uptake of EE measures, but the effectiveness of which depend on compliance and strong enforcement mechanisms.

Within the index framework, the factors are further broken into sets of quantitative and qualitative indicators (Table 1) which measure specific aspects relating to the factors, and which are used to determine scores in each area. These are presented and discussed individually in the subsequent sections.

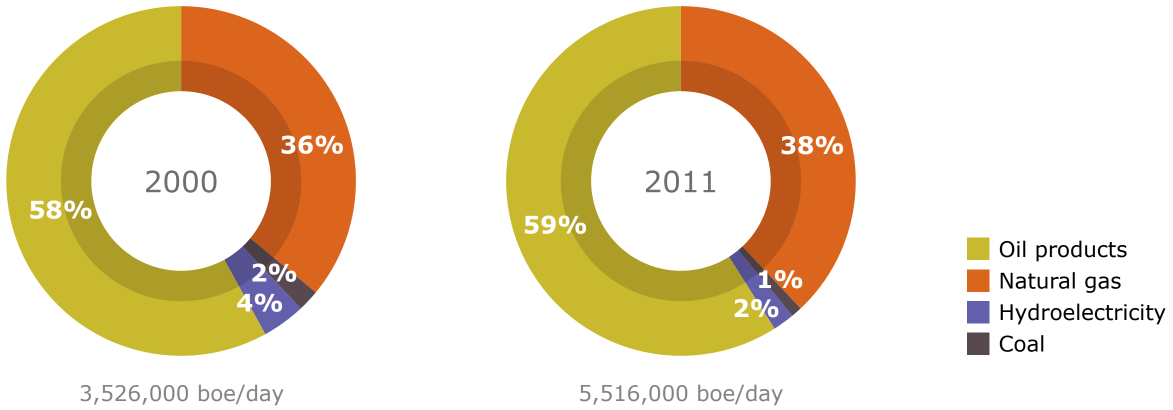
2. Current State of EE in the Region

2.1 Primary and Final Energy Consumption

Energy consumption in the region continues to be dominated by fossil fuels. As can be observed from Figure 2, the situation has not changed significantly since 2000. In 2011, the primary energy consumption mix was dominated by oil products (59%) and natural gas (38%), with coal (1%) playing a minor role, and hydroelectricity (2%) being the only form of renewable energy to make a measurable impact. All fossil fuel sources gained share except coal, while hydroelectricity lost half of its contribution in the energy mix.

The trend shows a 56% increase in the region's total primary energy consumption, from 3,526,000 to 5,516,000 barrels of oil equivalent (boe) per day. On an absolute basis, consumption of all forms of energy increased over the period, with the exception of hydroelectricity.

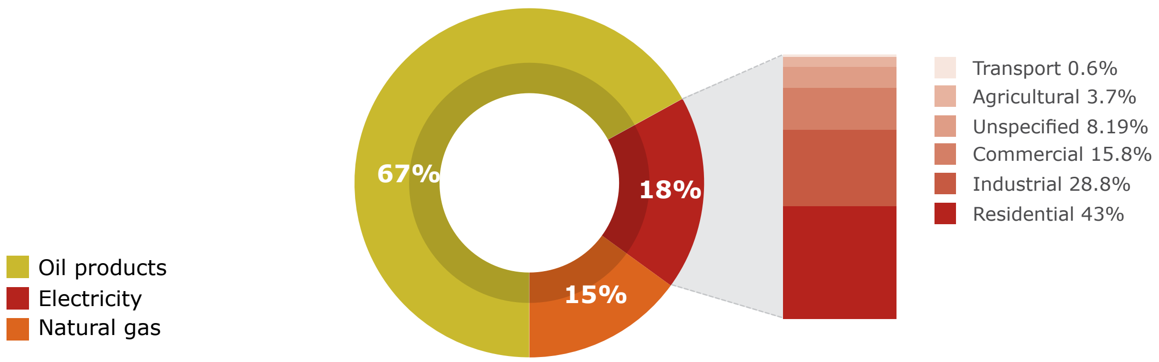
Figure 2: Primary energy consumption of RCREEE member states (2000 and 2011)



Source: OAPEC (2005, 2012)

Figure 3 illustrates the region's final energy consumption in 2009. Electricity accounted for only 18% of the total final energy consumption, whereas oil products accounted for 67%. Electricity consumption was largely dominated by the residential (43%) and the industrial (28.8%) sectors, while the commercial and agricultural sectors accounted for 15.8% and 3.7%, respectively.

Figure 3: Regional final energy consumption (2009)

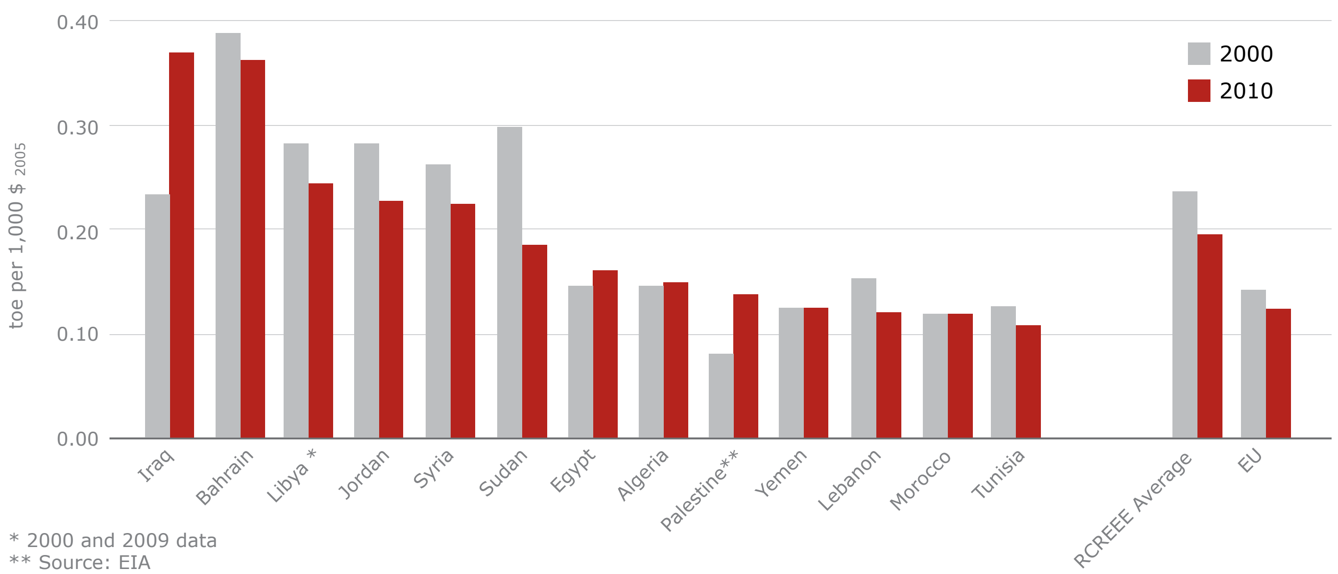


Source: RCREEE based on data from various national authorities

2.2 Energy Intensity and Economic Decoupling

Figure 4 below shows the primary energy intensity of the region's countries at the macro level, with a comparison to the European Union. Primary energy intensity is defined as the ratio between a country's total primary energy consumption and the Gross Domestic Product (GDP). It measures the amount of energy input required to generate one unit of GDP. By expressing the GDP in US dollars at purchasing power parity (all data being in constant 2005 international dollars), GDP is adjusted to reflect the differences in the cost of living in different countries (ENERDATA, 2012). The average primary energy intensity in the region, measured in tonnes of oil equivalent per 1,000 $$_{2005}$, decreased slightly over the past decade while remaining much higher than the European Union's energy intensity. This implies a disadvantage for producers of goods and suppliers of services in the Arab region, based on the higher energy inputs required to generate economic value.

Figure 4: Energy intensity of RCREEE member states (2000 and 2010)

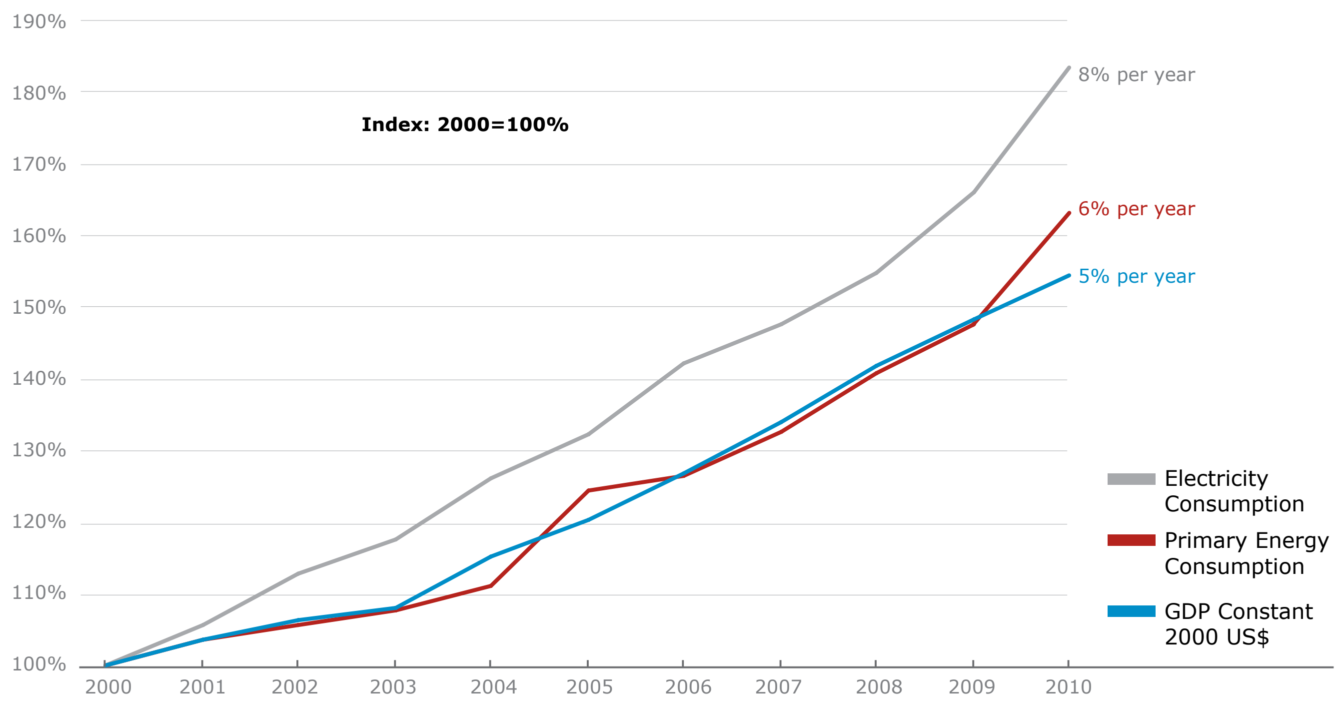


* 2000 and 2009 data
** Source: EIA
Source: RCREEE estimation based on data from World Bank and national authorities

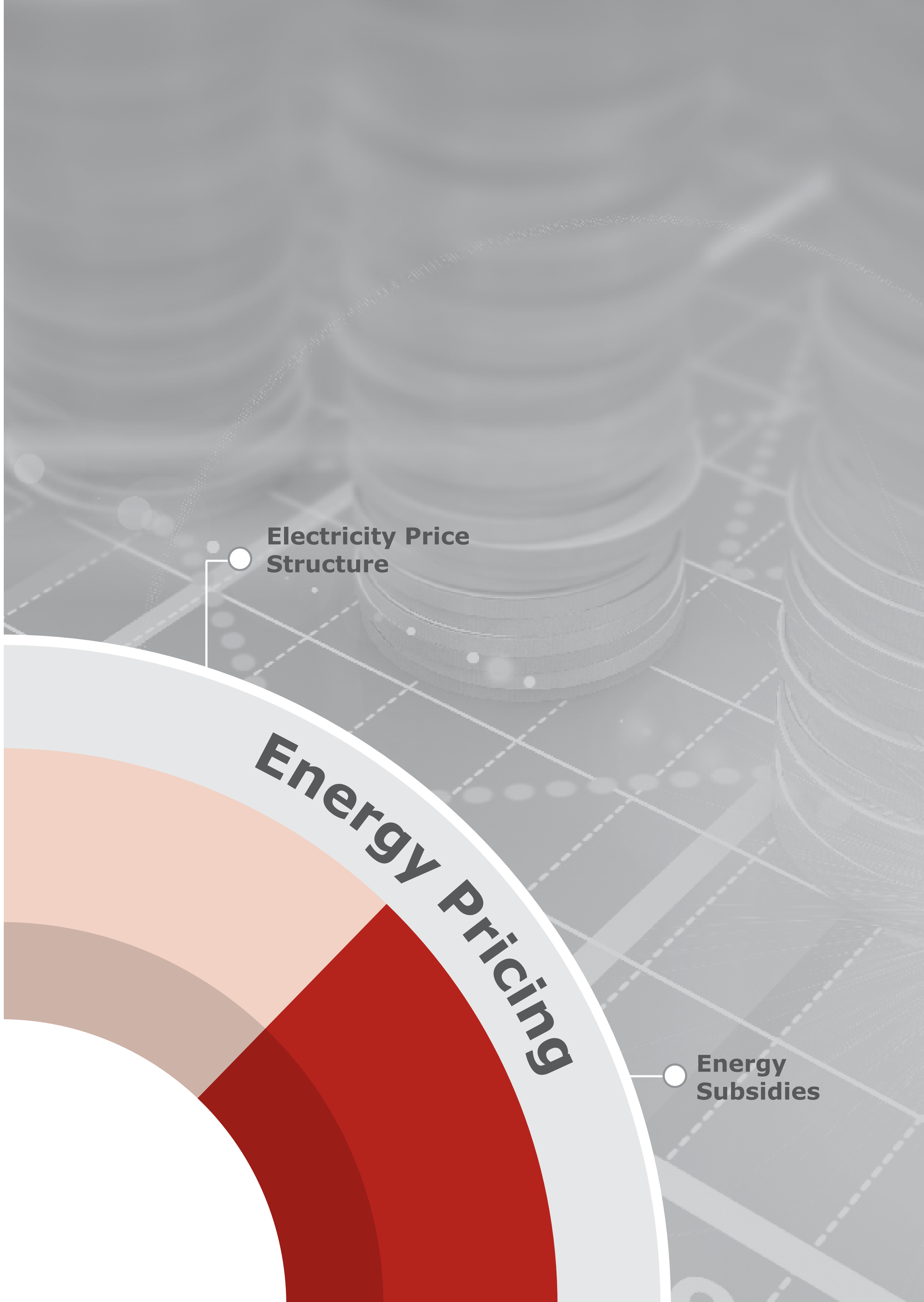
Figure 5 demonstrates no indication of decoupling between economic growth and energy consumption in the region in the past decade. The concept of decoupling refers to the process of 'dematerialization', where less resources (material, energy, water and land resources) are used to generate the same economic output. In other words, decoupling means greater efficiency, less negative environmental impacts, maintaining the same level of economic growth and comfort (UNEP, 2011). On the contrary, an absence of decoupling indicates economic growth that is driven by increased resource exploitation.

In the region, growth in energy consumption has been faster than economic growth during the past decade; average annual GDP growth was around 5%, while the increases in primary energy and electricity demand have been about 6% and 8%, respectively. This trend implies the effectiveness of energy use has decreased over the last ten years in relation to value generated for the regional economies.

Figure 5: Decoupling of energy consumption from economic growth (2000 to 2010)



Source: RCREEE estimation based on data from OAPEC (2005, 2007, 2012); World Bank (2013); EIA (2013)



3. Category 1: Energy Pricing

The Energy Pricing category assesses the level of demand for EE services in RCREEE member states by looking at the structure of energy pricing. This category consists of two factors: (1) electricity price structure; and (2) energy subsidies. As illustrated in Table 2, these factors are further measured by three quantitative indicators.

Table 2: Energy Pricing

Category	Factors	Indicator	Score/Measuring Unit
Energy Pricing	Electricity price structure	Time of use price structure	Number of segments
	Energy subsidies	Subsidy amount in residential sector	% (benchmarked to Palestinian retail prices for electricity)
		Subsidy amount in industrial sector	% (benchmarked to Palestinian retail prices for electricity)

3.1 Electricity Price Structure

Why this indicator?

The existence of a differentiated electricity pricing structure – according to time, location and quality of supply – is a strong mechanism to incentivize consumers to use energy more rationally and reduce peak loads (ESMAP, 2009). Depending on the extent of metering and policy considerations, different time-differentiated price structures can be used. These can include time-of-use rates, real time pricing, critical peak pricing and others (Prindle, 2009; Braithwait, 2007). Time differentiated price structures signal to consumers that energy usage can be more expensive depending on when it is used, thereby inducing changes in energy consumption patterns (Prindle, 2009).

Time-of-use (TOU) pricing is one of the most common forms of time-differentiated price structure. It encourages consumers to be more selective in their energy use by allowing the utility to charge different prices during the peak and off-peak periods. Time-of-use has two important economic impacts: (1) by reducing the peak load, one reduces the resources required to supply energy at peak times; and (2) additional capacity can be designed to serve the system's base load instead of peak load (ESMAP, 2009). TOU pricing provides high incentive for customers toward peak demand reduction, medium incentive for overall energy savings and low financial risks for utilities due to rates being more representative of true utility costs, which reduces the risk of failing to recover costs (Prindle, 2009).

Research conducted in the Niagara Mohawk Power Corporation service area in the USA indicated that in areas where the utility offered TOU tariffs for large customers with peak demand needs, more than 30% of industrial customers responded by giving up discretionary electricity consumption and 15% shifted their consumption from peak periods to

off-peak periods; 45% installed demand reduction enabling technologies on site; and peak load for the utility was reduced by 15% (Sovacool, 2009). While time-differentiated rates do not necessarily imply minute-by-minute prices, they do provide meaningful differences between peak and off-peak consumption (Sovacool, 2009).

Results of assessment

None of the RCREEE member states apply TOU price structure for residential or low voltage customers. However, some of them apply some type of TOU electricity price structure for medium, high and extra high voltage customers. Table 3 provides details about the countries that apply a TOU price structure for industrial and large energy consuming customers. These include Lebanon, Tunisia, Morocco, Jordan, Syria, Algeria and Egypt. Other countries use a flat rate for electricity consumption and do not apply any time-differentiated price structure. Lebanon and Tunisia apply the greatest number of segments in their price structures; Syria, however, applies TOU price structure to the largest spectrum of customers.

Table 3: Time-differentiated price structures

Country	Customers	Time-Differentiated Rates				
Algeria	High, medium and low voltage	Regular hours	Peak	Night		
Jordan	High and medium voltage	Day	Night			
Egypt	Extra high voltage and high voltage	Peak	Off-peak			
Lebanon	High voltage	Night 00:00 – 07:00	Day 07:00-18:30	Peak 18:30-21:30	Day 21:30-23:00	Night 23:00-00:00
Morocco	Extra high and high voltage	Mid-peak	Peak	Off-peak		
Syria	Extra high, high and medium voltage	Day	Night	Evening		
Tunisia	High and medium voltage	Day	Peak	Evening	Night	

Source: RCREEE focal points; national utility companies

It is important to note that for TOU price structure to be most effective in peak load reduction, electricity prices need to be sufficiently high to induce changes in consumption pattern and there must also be an uninterrupted supply of power. Due to these limitations, some countries in the region such as Lebanon and Syria do not enjoy the full positive impact of TOU price structure. In Lebanon, the current electricity system is unable to ensure sufficient uninterrupted power supply. Blackouts in the country range from three hours a day in Beirut to 12 hours a day in rural areas (Hasbani, 2011). Moreover, these blackouts occur in a sporadic manner which prevents industries from planning their operational activities effectively (Deghaili, 2013). Under such circumstances a TOU price structure has almost no effect, as the power is only sometimes available during peak hours. With the ongoing armed conflict and damages caused to electricity infrastructure, Syria currently faces a similar situation.

In contrast, countries that witness a positive impact from TOU price structure on peak load reduction are the ones with relatively high electricity prices and uninterrupted power supply such as Morocco. There the application of a TOU price structure at three industrial facilities – two cement producers HOLCIM Settat and HOLCIM Oujda, and one steel production company SONASID – resulted in 76 MW of peak load reduction on the power grid (New National Energy Strategy progress review, January 2013).

3.2 Energy Subsidies

Why this indicator?

Appropriate energy pricing is an essential part of EE policy. It has been empirically demonstrated that large price distortions resulting from energy subsidies constitute a key reason for low energy efficiency. Likewise, higher energy prices drive a more rapid rate of EE improvement (Ellis, 2010). Energy subsidies currently have a major impact on EE progress in the Arab world. The region has a strong tradition of maintaining relatively low consumer prices for fuels and electricity. Subsidies on average constitute more than 20% of governments' expenditures (ESMAP, 2009). In Egypt, energy subsidies accounted for 21% of the 2010 fiscal year budget and 73% of total subsidies (Castel, 2012). All countries in the region subsidize fossil fuel products, and most subsidize electricity (ESMAP, 2009; RCREEE, 2010).

Many studies have been undertaken to assess the impact of energy subsidies on national economies. A general consensus exists that despite social and economic goals that are targeted by electricity and fuel subsidies, they have a net negative effect, both on individual countries and on a global scale (Ellis, 2010). The biggest negative impact of electricity and fuel subsidies is price distortion, which in turn creates inefficiencies that lead to serious environmental, economic and social impacts. Energy subsidies encourage inefficient allocation of scarce resources, and wasteful and irrational consumption of energy. Furthermore, they discourage investments and efforts to develop more efficient systems. A natural consequence includes smuggling of petroleum products across countries' borders due to price disparities between neighboring countries (El-Katiri, 2012). This results in a public burden both by subsidizing other countries' energy costs and by the private profit from these sales.

How is this indicator measured?

Estimating the exact amount of subsidies is a challenging task due to different forms they may take, modes of implementation, poor data quality, limited data availability, secrecy of information and lack of transparency. The most common approach used in estimating subsidy levels is the so called 'price-gap approach', which compares domestic retail prices for fuel products against a certain benchmark or reference price (El-Katiri, 2012). The major limitation of this method is the existence of major disagreements among various stakeholders of what constitutes the proper reference price because a benchmark price may involve taxes and other charges, which represent significant components of retail fuel prices (El-Katiri, 2012; ESMAP, 2009).

Given the complexity of the issue and the crucial importance of electricity price subsidies for energy efficiency, a proxy has been used by RCREEE to estimate electricity subsidies in the region based on the price-gap approach, where Palestine's prices are used as a reference price. Palestine has very little power generation capacity and imports substantially all of its electricity. Electricity prices in Palestine are close to international prices and represent the approximate true retail cost. In all other RCREEE member states, prices are currently set by the national governments.

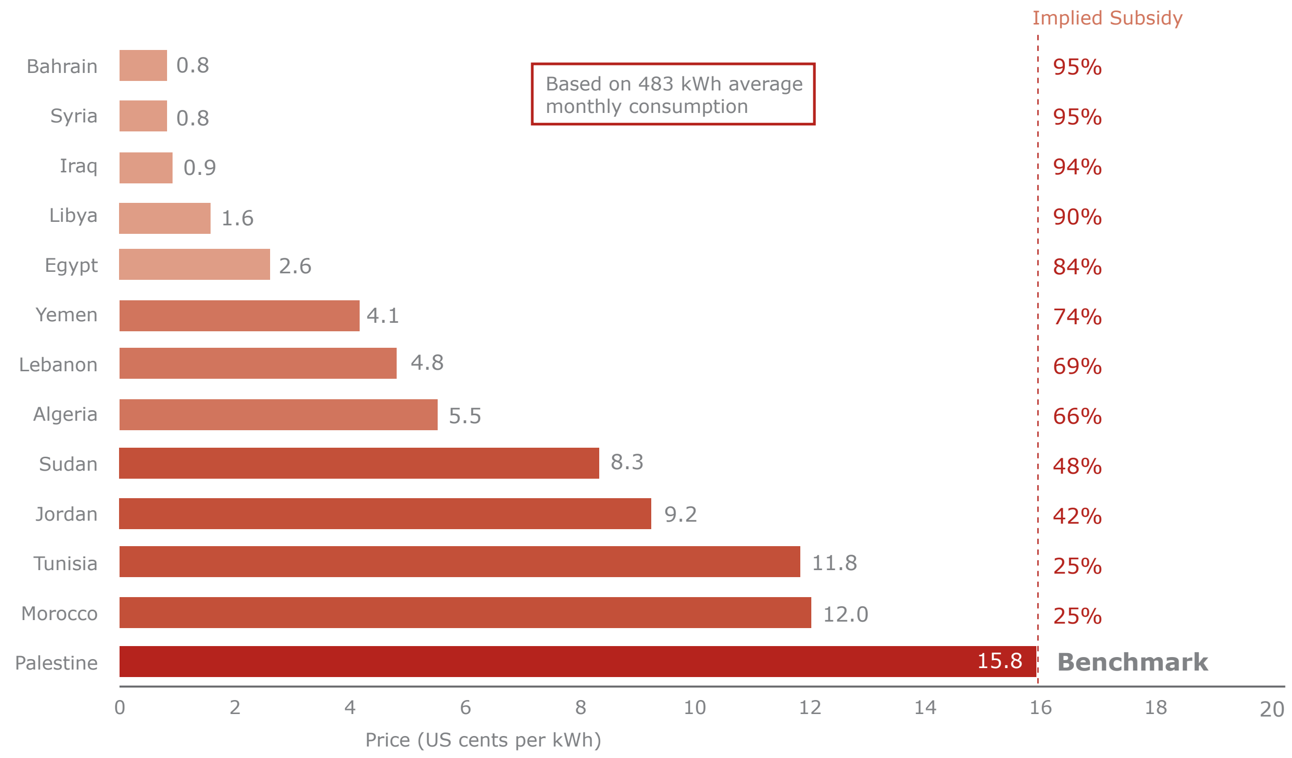
Results of assessment

Data on Arab electricity prices for residential and industrial customers are presented in Figures 6 and 7, respectively. These represent a typical customer, based on the average monthly consumption in 13 RCREEE member states. In 2011, for residential customers the average consumption was 483 kWh per month, and for industrial customers the average was 30,579 kWh per month (AUE, 2012). The price per kWh has been identified for an equal consumption level in each country using local utility rate structures. The electricity prices paid in each country are shown in the figures. The difference between Palestine's benchmark price and the price paid in each country is referred to as the implied subsidy.

Residential electricity is the most heavily subsidized sector, with implied subsidies ranging from 25% in Morocco to 95% in Syria and Bahrain. For industrial customers, more of the true costs are passed through, with some countries charging a flat rate and others employing multiple price tiers. The implied subsidy levels reflect this, with the highest discount being 80% in Libya and the lowest being in Morocco, where the price is 3% higher than the benchmark. There are several reasons for this situation in Morocco, including its high dependency on fuel imports, interconnection with the higher-priced Spanish market, a planned shift towards a deregulated market, and its pursuit of renewable energy development. Taken together, these factors have led the government to set electricity prices higher than its Arab neighbors.

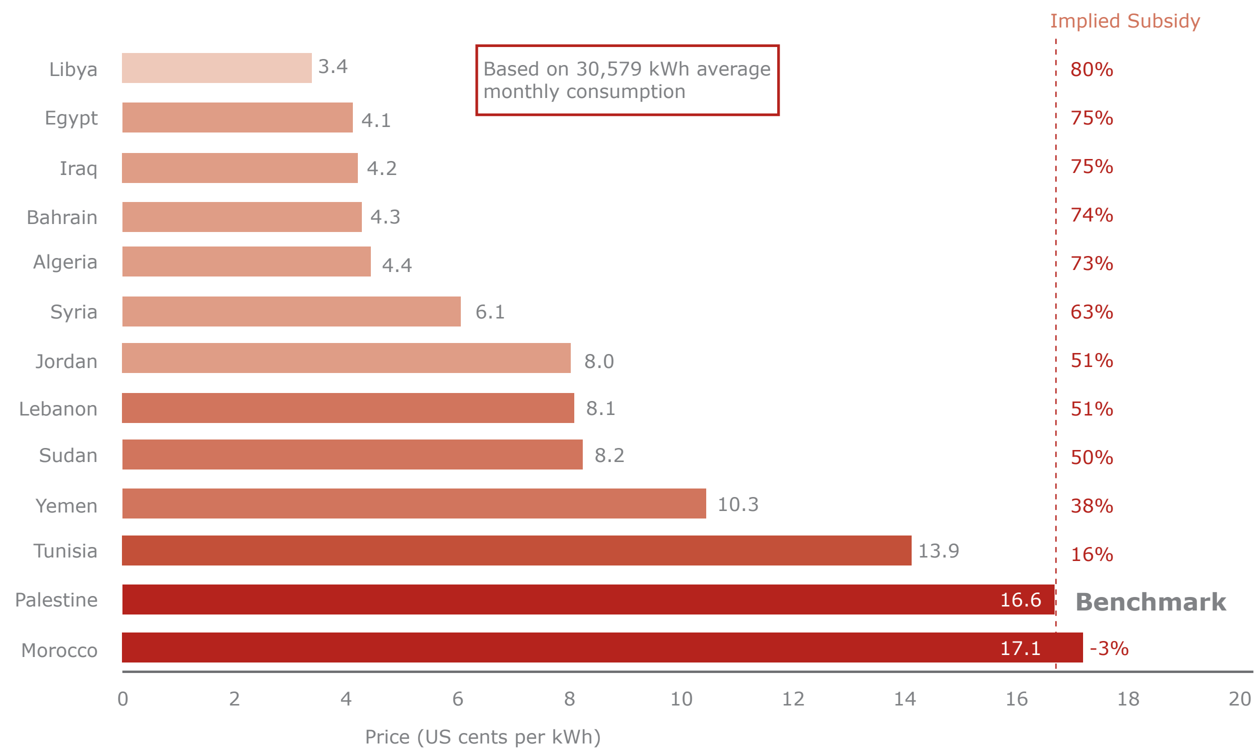
Energy Pricing

Figure 6: Residential electricity prices and subsidies benchmarked to Palestine (2011)



Source: Arab Union of Electricity (2012a, 2012b), developed by B. Samborsky, RCREEE

Figure 7: Industrial electricity prices and subsidies benchmarked to Palestine (2011)



Source: Arab Union of Electricity (2012a, 2012b), developed by B. Samborsky, RCREEE

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Energy Efficiency

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A limitation of this method is the assumption that more or less similar fuel types are used in generation, and the cost of electricity production is similar within the region, which is not necessarily the case. In Sudan, for example, 58% of electricity is hydro-based and in Egypt 10.2% is produced from renewables, but on average 92.1% of the region's electricity is produced from fossil fuels (Arab Union of Electricity, 2011). The goal of this indicator is not to provide a precise measure of subsidies, but rather depict the current situation of subsidies in the power sector.

3.3 Rank under Energy Pricing Category

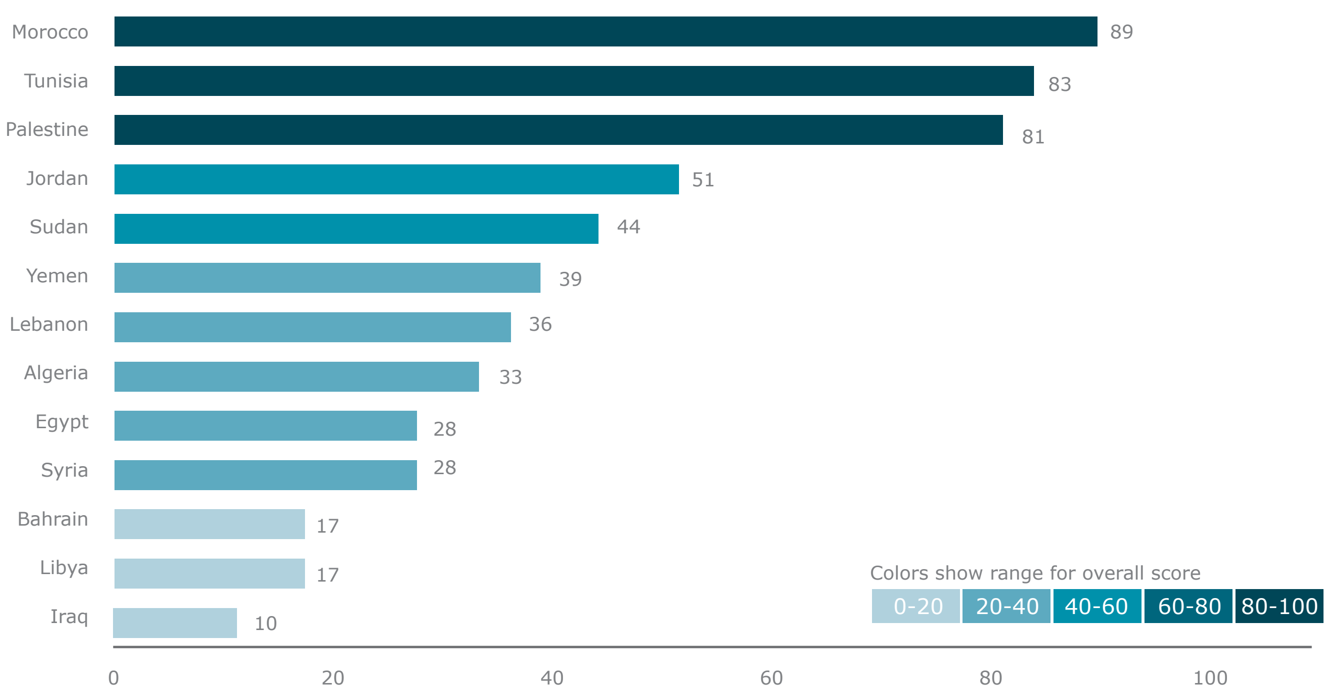
The Energy Pricing category final scores are presented in Table 4. As can be observed from this table, Tunisia leads under the TOU price structure indicator as it applies the most segments in time-differentiated price structure to industrial customers. In the subsidy indicators the two leading countries are Morocco and Palestine, as they have the highest electricity prices in the region.

Table 4: Final scores under Energy Pricing category

	TOU Price Structure	Residential Electricity Subsidies	Industrial Electricity Subsidies
Algeria	32	37	29
Bahrain	10	10	29
Egypt	23	22	35
Iraq	10	11	10
Jordan	36	60	50
Lebanon	10	35	50
Libya	10	15	23
Morocco	93	76	100
Palestine	10	100	97
Sudan	10	55	51
Syria	40	10	39
Tunisia	100	76	82
Yemen	10	30	62

Figure 8 represents final scores and ranks of countries under the Energy Pricing category. The leading country in this category is Morocco, followed by Tunisia and Palestine. Ranks under this category closely correlate to electricity prices in the region. The countries with relatively high electricity prices and thus low energy subsidies are leading this category. Tunisia ranks ahead of Palestine because of its performance in the 'TOU price structure' indicator. The countries lagging behind in this category have the lowest electricity prices in the region and apply no special tariffs to encourage rational use of energy.

Figure 8: Final scores and rank under Energy Pricing category



4. Category 2: Policy Framework

An effective legislative framework is an important factor in fostering and enabling EE. According to the 2010 IEA report "Energy Efficiency Governance", key elements of effective legislative framework include clear government intent and commitment for EE improvement; high-level and long-term focus; specific, quantitative and time-bound EE objectives; an assigned agency for planning, designing and implementing EE measures; dedicated funding and resources to achieve the stated goals and objective; and effective oversight of policies and measures such as monitoring and reporting (IEA, 2009, 2010). As such, the AFEX Energy Efficiency Policy Framework category consists of three major factors: (1) Energy Planning; (2) Regulatory Framework; and (3) Financial Incentives. Table 5 below presents in more detail the factors and indicators considered under this category.

Table 5: Policy Framework

Category	Factors	Indicator	Score/Measuring Unit
Policy Framework	Energy planning	Energy strategy with long term EE objectives	Officially adopted (1); nonexistent (0)
		Action plan with quantitative time bound EE indicative targets (macro; residential/ tertiary; industrial, utility)	
	Regulatory frame-work	Framework legislation for EE measures	Adopted (1); draft prepared (0.5); nonexistent (0)
		EE regulations for buildings	Mandatory (1); voluntary/under preparation (0.5); non-existent (0) Statutory obligation to install solar water heaters in new buildings (0.5)
		Minimum energy performance standards with labeling schemes for household appliances	
		Regulatory phase-out of inefficient lighting technology	Existent (1); non-existent (0)
		EE regulations for industries	Number of policy measures
	Financial incentives	EE Fund	Established by law (0.5); sources of financing are clear (0.5); disbursement procedure is clear (0.5)
		Internal tax benefits	Number of tax benefits
		Customs duty for CFLs and SWHs	%

4.1 Energy Planning

Why this indicator?

Energy planning is a critical step in pursuing an effective EE strategy. Energy planning involves various activities including estimating EE potential, identifying barriers to cost-effective EE investments, setting long-term and intermediate national indicative savings targets, prioritizing measures, setting EE goals and objectives, formulating policies and developing specific action plans (Snuller Price et al., 2007). Strategic energy planning allows for more effective tackling of pervasive market barriers and failures that cannot be solved on an ad-hoc basis and require a strategic and holistic approach.

Energy efficiency objectives that are clearly identified with specified timelines constitute one of the attributes of successful EE strategies. EE targets are useful to motivate implementing agencies to be more proactive and to measure the progress of EE initiatives. Targets also provide a basis for long-term EE programs and provide justification for obtaining funding. For targets to be useful in measuring progress, they should be supported by a strong analytical base, high quality data and a transparent measurement procedure.

Targets can be expressed in different ways while keeping in mind the SMART principles: specific, measurable, ambitious, realistic and time-bound. Sector and subsector level targets are most effective as they are capable of producing overall EE savings at lower costs. These can make allowance for differences in potential for improvement in each sector. Targets can be described as desired objectives that should reflect the intended change from the baseline situation. An analysis of the current situation and linking this to the expected results is the basis for setting realistic and measurable (or at least verifiable) objectives. It is essential that the baseline is known at the outset and that objectives are precise enough to allow verification of their achievement.

On 25 November 2010, the Arab Energy Efficiency Guidelines were adopted based on the European Directive 2006/32/EC on energy end-use efficiency and energy services. (Arab Ministerial Council for Electricity, 2010) According to this guideline, Arab states are required to develop National Energy Efficiency Action Plans (NEEAPs) to achieve comprehensive energy savings by 2020. The NEEAPs are to be prepared for a period of three years with an indicative target for energy savings. Countries 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)

Results of assessment

On a regional level, five countries – Algeria, Jordan, Morocco, Palestine and Tunisia – have officially adopted a long-term energy strategy with EE objectives. Bahrain adopted Economic Vision 2030, wherein Article 3.5 expresses commitment for EE. However, this vision is vague and does not contain specific EE objectives. The whole document represents an expression of intent rather than a real public commitment. States that have adopted official NEEAPs include Lebanon, Tunisia, Egypt, Palestine and Sudan. Table 6 highlights the status of the region's countries regarding their NEEAPs. Syria, Jordan and Libya have prepared drafts, but have not officially approved their NEEAPs yet. Morocco, Algeria and Bahrain are in early stages of preparation. Yemen and Iraq have expressed interest in preparing NEEAPs.

Table 6: Status of the adoption of energy strategies and NEEAPs

	National Energy Strategy with Long-Term EE Objectives	National Energy Efficiency Action Plan (NEEAP)
Algeria	National Program for Renewable Energy and Energy Efficiency by 2030 adopted in 2011.	NEEAP is under preparation
Bahrain	The Economic Vision 2030 for Bahrain (Article 3.5)	Conceptual stage
Egypt	None	NEEAP (2012-2015)
Iraq	Master Plan of Energy 2030 adopted in June 2013	Conceptual stage
Jordan	Jordanian National Energy Plan 2007-2020	NEEAP is under preparation
Lebanon	Policy Paper for Electricity Sector (2010)	NEEAP (2011-2015)
Libya	None	NEEAP is under preparation
Morocco	National Energy Strategy adopted in January 2013 (2012-2020)	NEEAP is under preparation
Palestine	National Energy Strategy (2012-2020)	NEEAP (2012-2014)
Sudan	None	NEEAP (2013-2016)
Syria	None	NEEAP is under preparation
Tunisia	Triennal program (2005-2007) Quadriennal program (2008-2011) New energy program for 2013-2016 is currently under development	NEEAP (2005-2007) NEEAP (2008-2011) NEEAP (2013-2016) is Under development
Yemen	National Renewable Energy and Energy Efficiency Strategy adopted in 2009	none

Source: RCREEE focal points; RCREEE Energy Efficiency country profiles (2013)

When measuring EE targets, only targets stated in NEEAPs are accounted for because NEEAPs specify how targets will be achieved, what resources will be assigned and which agency will be responsible for implementation. Based on the recommendations outlined in the Arab EE Guidelines, EE targets in NEEAPs are assessed according to well-defined criteria. For the five countries that currently have NEEAPs, their EE indicative targets are compared in Tables 7 to 11.

Table 7: EE indicative targets - Egypt

Sector Specific	Quantitative and Time Bound					Clear Baseline Consumption
	2020 Target		Interim Target			GWh/5 Years Average
	%	GWh	%	GWh	Target Year	
Macro	-	-	4.96	5,565.69	2015	112,162.8
Residential and Tertiary	-	-	4.96	5,565.69	2015	112,162.8
Industrial	-	-	-	-	-	-
Utility	-	-	-	-	-	-

Source: NEEAP of Egypt

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Table 8: EE indicative targets - Lebanon

Sector Specific	Quantitative and Time Bound					Clear Baseline Consumption
	2020 Target		Interim Target			GWh/5 Years Average
	%	GWh	%	GWh	Target Year	
Macro	5 [1]	-	-	-	-	-
Residential and Tertiary	5	-	12	-	2013	5,570 (buildings) 2,500 (govern)
Industrial	5	-	2	80	2013	3,627
Utility		-	-	-	-	-

Source: NEEAP of Lebanon

Table 9: EE indicative targets - Palestine

Sector Specific	Quantitative and Time Bound					Clear Baseline Consumption
	2020 Target		Interim Target			GWh/5 Years Average
	%	GWh	%	GWh	Target Year	
Macro	5	426	1	54	2014	4,114
Residential	6	363	1	38		2,880 (Buildings)
Tertiary	1	2	0	0		41 (Others)
Industrial	2	19	1	5		370
Utility	3	42	1	11		823

Source: NEEAP of Palestine

Table 10: EE indicative targets - Sudan

Sector Specific	Quantitative and Time Bound					Clear Baseline Consumption
	2020 Target		Interim Target			GWh/5 Years Average
	%	GWh	%	GWh	Target Year	
Macro	33	2,029	12	775	2016	6,210
Residential	18	1,139	6	350		-
Tertiary	14	425	7	425		-
Industrial	0.95	-	-	-	-	0.6-0.8 [2]
Utility						

Source: NEEAP of Sudan

Table 11: EE indicative targets - Tunisia

Sectors	Target (toe)	Date
Buildings	1,010	2008-2011
Industrial	730	
Transport	290	
Agriculture	2	
Power Generation with Renewable Energy	470	
Total	2,500	
Additional Target	3% reduction in energy intensity	Annual

Source: Quadriennal program 2008-2011

1 Target is expressed as a growth reduction rate
2 Target is expressed as enhancing power factor

The countries that scored highest under this indicator are Tunisia and Palestine. Palestine provides clear time-bound EE targets with baseline consumption calculated both at the macro level and at sector-specific levels. Most countries' formulation and estimation of targets is in line with the methodology suggested by the Arab EE Guidelines. According to these guidelines, EE indicative targets should be expressed both as a percentage of the baseline consumption and as specific GWh to be saved. Thus the core task of EE indicative target setting is a precise calculation of the baseline consumption.

Baseline electricity consumption should be calculated as the annual average of final electricity consumed during the five years prior to adopting the NEEAP. The same methodology should be applied for target setting at the sector-specific level. The Arab EE Guidelines stress that total calculated energy savings should be a fixed amount, independent of GDP growth or any future increases in energy consumption.[3]

4.2 Regulatory Framework

Policy measures are necessary to foster and enable the uptake of EE improvements and induce positive changes in consumer behavior (UNDP, 2010). Policy instruments can be designed as regulatory, financial- or market-based, or information-based. Each policy instrument has its own advantages and disadvantages with results depending on many factors, including design of the instrument, suitability of the instrument to the context, implementation and enforcement factors. There is no one best instrument for all situations; similar instruments can have different results in different countries. However, based on experience, some policy instruments have proven to work more effectively than others (UNDP, 2010).

4.2.1 Framework Legislation for EE Measures

Why this indicator?

Framework laws on EE represent stronger political commitment towards EE because they are usually adopted by higher legislative authorities in the country such as national parliaments and thus involve wider stakeholder participation. From a pragmatic perspective, framework laws are important because in certain cases they establish the necessary pre-condition or statutory basis for executive authorities to adopt a regulatory piece. In other words, framework laws enable or directly prescribe executive bodies to adopt more detailed and specific implementation of EE measures in the form of bylaws, regulations, or standards, which then serve as an enabling factor for EE measures. For example the Tunisian framework Law No 2004-72 has been marked as a critical turning point because it established EE as a national priority and reinforced the key position of the National Agency for Energy Conservation (EQUITER S.p.A., n.d.).

Results of assessment

In RCREEE member states, almost half the countries have adopted general laws on energy conservation and renewable energy. Except for Algeria and Tunisia, these legislative initiatives represent relatively recent trends and therefore not many implementing bylaws have been adopted yet. Table 12 summarizes the framework legislation relating to EE in RCREEE member states.

Table 12: Framework legislation for EE measures

	Framework Legislation for EE Measures
Algeria	Law No. 1999-09 (1999) on energy conservation
Bahrain	None
Egypt	Draft electricity law with a chapter on EE
Iraq	None
Jordan	Law No. 13 (2012) on renewable energy and energy efficiency
Lebanon	Draft law on energy conservation
Libya	None
Morocco	Law No. 47-09 (2009) on energy efficiency
Palestine	None
Sudan	None
Syria	Law No. 3 (2009) on energy conservation
Tunisia	Law No. 2004-72 (2004) on energy efficiency further amended by Law No. 7 (2009)
Yemen	None

Source: RCREEE focal points, RCREEE Energy Efficiency country profiles (2013)

3 Appendix A-The methodology for calculating the national indicative target for energy savings, Arab Guidelines, 25 Nov 2010

4.2.2 EE Regulations for Buildings

Why this indicator?

There are two main approaches to improving energy performance in the building sector: (1) reducing buildings' energy demand; and (2) integrating renewable sources of energy in the building system (UNDP, 2010). In improving energy performance of buildings, special attention should be paid to activities that have the highest energy consumption. Energy performance of buildings depends not only on the performance of individual critical elements such as thermal envelope, windows and mechanical equipment, but also on how they perform as an integrated system. Therefore building design is important for integrating all EE influencing factors such as construction materials, building layout and others (Gelil, 2011).

Mandatory EE regulations, if enforced adequately, can provide a strong driving force for the construction industry to start developing and producing more energy efficient buildings and integrating energy efficient solutions. Similarly, standards can have strong leverage on the entire supply chain to start producing more energy efficient construction materials (Feng Liu, 2010). Such standards can also help capture the largest EE potential in buildings at the lowest cost since they are targeted at the design and construction phases (IEA, 2008).

Results of assessment

On a regional level, almost half of the countries have adopted mandatory and voluntary EE regulations while others are in the process of preparation. Table 13 illustrates the current status of EE regulations for buildings.

Table 13: Status of EE regulations for buildings

Mandatory			
Algeria	Thermal regulations for new buildings (2000)	Jordan	EE building code (2009)
Bahrain	Thermal insulation implementation for buildings above 4 storeys (2000)	Syria	Building thermal insulation code (2007), effective since 2009
Egypt	EE code for residential buildings (2006); EE code for commercial buildings (2009); EE code for governmental buildings (2011)	Tunisia	Minimum EE specifications for administrative buildings (2008); Minimum EE specifications for residential buildings (2009)
Voluntary			
Iraq	Voluntary reference EE specifications for buildings (2012)	Palestine	Voluntary EE building code (2004)
		Morocco	Technical specifications for thermal regulations in building (2010)
Under Preparation			
Lebanon	EE building code	Tunisia	Minimum EE performance specifications for hospitals and hotels
Morocco	Technical specifications for passive and active components of buildings		

Source: RCREEE focal points, RCREEE Energy Efficiency country profiles (2013)

4.2.3 Minimum Energy Performance Standards for Appliances

Why this indicator?

To reduce energy consumption of household appliances and office equipment, many countries have introduced minimum energy performance standards (MEPS) for household appliances and office equipment, often followed by labeling programs. MEPS define an EE performance threshold for appliances and equipment, thereby preventing the entry of inefficient products into the market (World Energy Council, 2008).

Labeling programs aim to provide consumers with information on energy consumption of appliances or equipment, thereby allowing buyers to compare and make informed choices. The main purpose of labeling is to stimulate technological innovation and the introduction of more efficient products (World Energy Council, 2008). Most countries focus first on refrigerators and air conditioners, since these appliances account for the largest household electricity consumption. Experience shows that MEPS together with labeling programs are effective in reducing energy consumption of appliances and equipment. The EU labeling scheme improved refrigeration efficiency by 25% from 1992 to 1999 (World Energy Council, 2008). The current MEPS status for member states is listed in Table 14.

Table 14: Status of MEPS for Household Appliances

Appliance	Algeria	Bahrain	Egypt	Iraq	Jordan	Lebanon	Libya	Morocco	Pales-tine	Sudan	Syria	Tunisia	Yemen
Refrigerators	m		m		m	v					m	m	
Washing Machines			m										
Air Conditioners	m	m	m		m	v						m	

Source: RCREEE focal points, PWMSP (2012)
m – Mandatory, v – Voluntary

4.2.4 EE Lighting

Why this indicator?

In the Arab region, the en.lighten initiative[4] estimated the potential electricity savings, CO_2 emission reduction, and resulting economic benefits from phasing out incandescent light bulbs (Gelil, 2011). According to this study the total energy savings for the whole region would constitute 20 TWh per year resulting in reduction of 571 Mt per year CO_2 emissions. Potential energy savings for individual countries depend on their patterns of energy consumption, fuel mix for electricity generation and level of EE. Algeria is estimated to have the highest energy savings potential (14%) and Egypt the lowest (4.2%) from phasing out inefficient lighting technology (Gelil, 2011). Average payback period is about 1.6 years. Table 15 provides more detailed information on the potential for energy savings in the region, and Table 16 reports on the phase-out of inefficient lighting.

Table 15 Potential of energy savings from phase-out of inefficient lighting technology

	Energy Savings (TWh/year)	Energy Savings (%)	Total CO_2 Emissions Reductions (Mt/year)	Annual Financial Savings (million USD/year)	Payback Period (years)
Algeria	4.2	14	86	335	1
Egypt	4.7	4.2	169	331	1.1
Iraq	2.4	6.7	92	120	1.6
Jordan	0.9	7.8	19	104	0.7
Lebanon	0.7	7.4	11	65	0.9
Libya	1.2	6.6	43	36	2.7
Morocco	1.8	8.3	41	263	0.7
Palestine	0.2	4.5	2.3	17	0.8
Sudan	0.3	7.7	11	28	2.1
Syria	2.2	8.3	54	44	4
Tunisia	0.9	6.9	22	45	2.7
Yemen	0.5	11.4	21	55	0.7
Total	20	6.75	571	1,443	1.6

Source: Gelil (2011)

4 en.lighten initiative is a public/private partnership between the United Nations Environment Programme, OSRAM and Philips Lighting, with the support of the Global Environment Facility. Its main purpose is to accelerate global market transformation to environmentally sustainable, energy efficient lighting technologies.

Results of assessment

Table 16: Regulatory phase out of inefficient lighting technology

	Regulatory Phase out of Inefficient Lighting Technology
Algeria	None
Bahrain	None
Egypt	None
Iraq	None
Jordan	None
Lebanon	None
Libya	None
Morocco	None
Palestine	None
Sudan	None
Syria	None
Tunisia	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
Yemen	None

Source: RCREEE focal points, RCREEE Energy Efficiency country profiles (2013)

4.2.5 EE Regulation of Industries

Why this indicator?

The industrial sector in the region represents an important opportunity for improving EE. For example, in Morocco between 1990 and 2006, 57 energy audits identified 411 EE projects. 25% of these EE projects had a payback period of less than 1 year, 50% of the projects had payback between 1 to 3 years, 11% of projects between 3 and 5 years and only 14% of the projects had payback periods of more than 5 years (Lahbabi, 2013).

In Tunisia, a cooking oil production company, Nejma Huiles, has experienced benefits by implementing various EE measures. These resulted in energy savings of 2,257 toe per year, equivalent to 32% of the company's energy consumption, and reducing the energy bill by 36%. The payback period was 2 years 10 months. Implementing a co-generation project in the same plant resulted in energy savings of 1,249 toe per year, which is 17% of energy consumption, and reducing energy costs by 25%. Payback period was 3 years 7 months (MEDENER).

Taking action through industrial consumers can generate results with a relatively small number of participants if the appropriate ones are targeted. For instance in Egypt, where more than 40% of total energy is consumed by the industrial sector, the energy intensive industries represent 1% of the number of factories and consume 65% of the industry energy share. Clearly these few consumers can significantly contribute to EE efforts. The most widespread potential exists in co-generation, waste heat recovery, fuel switching and improved process control.

Reducing energy intensity in the industrial sector has the potential for substantial savings, both directly through reduced consumption of raw materials and indirectly through an improved quality of environment. Successfully advancing the energy performance of the industrial sector can be achieved with the help of adapted policies and well-implemented best practices.

Results of assessment

On a regional level, only three countries – Algeria, Syria and Tunisia – have adopted policies that specifically target EE in the industrial sector. Elsewhere there are no focused policies, but only some incentive mechanisms such as providing subsidies for energy audits. However, Morocco, Lebanon and Palestine are considering the introduction of mandatory energy audits for large energy consumers. Table 17 outlines the current state of regulation for the industrial sector.

Policy Framework

Table 17: EE regulation of industries in RCREEE member states

Algeria	Executive Decree No. 05-495 (2005)
	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	None
Egypt	None
Iraq	None
Jordan	None
Lebanon	Under discussion to introduce mandatory energy audits for establishments annual energy consumption exceeds 40 toe
Libya	None
Morocco	Under discussion to introduce mandatory energy audits
Palestine	Under discussion to introduce mandatory energy audits
Sudan	None
Syria	Energy Conservation Law provides for mandatory energy audits for state-owned industries
Tunisia	Decree No 2004-2144 (2004) as amended by decree No 2269-2009 of 31 July 2009
	For industrial establishments with annual energy consumption exceeding 800 toe: - Mandatory energy audits -Mandatory energy management system (home energy) - 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
Yemen	None

Source: RCREEE focal points, APRUE (2010)

Algeria

In 2005 Algeria adopted executive decree No. 05-495 which prescribes mandatory energy audits for industries whose total annual energy consumption exceeds 2,000 toe. Total energy includes consumption of all forms of energy including electricity, solid, liquid and gas, but excluding renewable energy (Article 11). Article 16 of the decree prescribes institutions, whose energy consumption exceeds the specified threshold to report on their energy consumption every three years. Reporting should be based upon the results of an energy audit conducted by a certified energy audit office. In addition, such facilities are required to designate a person responsible for implementing their energy management system (Article 17-19).

Another initiative to improve industrial EE in Algeria includes the Top-Industry program, which provides assistance to industrial facilities by conducting techno-economic studies on potential improvements in EE in the industrial sector. Studies conducted under this scheme have included feasibility studies on the restarting of a 14 MW gas turbine generator, the recovery of thermal energy from the heating of pre-treatment baths in a furnace for zinc and on the use of an existing 2.1 MW steam turbine.

Investment support granted under the Top-Industry program has included such projects as replacement of electric pumps rated at 210 kW with pneumatic pumps at 37 kW; installation of an 800 kW variable speed electric motor driving a fan; replacement of two boilers of 2.5 Gcal per hour by one of 3 Gcal per hour; and replacement of furnace burners with new-generation high efficiency burners (RCREEE country study for Algeria, 2010).

Tunisia

Tunisia has the most comprehensive policy framework for promoting energy efficiency in the industrial sector in the region. It consists of a wide range of measures including regulatory, fiscal and financial instruments. In addition to measures listed in Table 18, Tunisia has recently introduced a "contract program" for major industries. The contract program consists of signing voluntary bilateral agreements with large energy consumers aimed at achieving certain EE targets. During the period from 2000 to 2012, ANME concluded 490 bilateral agreements with industries and 148 agreements in the tertiary sector (Khalfallah, 2013).

To assist in achieving EE targets specified in contract programs, the following support schemes are available for EE projects (Decree No 2205-2234 (2005) as amended by the Decree No 2009-362 (2009):

- 70% of energy audit costs with a ceiling of TND 30,000

- 70% for immaterial investments with a ceiling of TND 70,000
- 20% for 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.

Other financial incentives include subsidies for co-generation, substitution of natural gas, setting up stations for engine diagnosis and installing EE equipment on fishing units (Decree No 2205-2234 (2005) as amended by Decree No 2009-362 (2009).

To finance EE projects two dedicated credit lines were established:

- Credit line financed by the World Bank with total capital of USD 40 million provides long-term loans with a guarantee from the Tunisian government for co-generation and industrial EE projects.
- Credit line financed by the French Development Agency with total capital of EUR 40 million provides loans for co-generation, EE and RE projects.

As a result of the successful implementation of this EE program for the industrial sector, Tunisia reduced industrial energy intensity from 0.440 toe per 1,000 DT_{1990} in 1990 to 0.330 in 2009. During the seven year period between 2004 and 2011, Tunisia achieved total energy savings of 1,400 ktoe. 93% of these savings were achieved through implementation of EE improvements identified during energy audits and 7% through implementation of the co-generation program. In the current draft of the national EE action plan for 2013 to 2016, energy savings in the industrial sector are planned to provide around 50% of the total savings to be achieved by 2016 (K. Lihidheb, 2013).

4.3 Financial Incentives

Why this indicator?

Lack of adequate financing for EE projects is one of the biggest challenges to EE in general. Reasons for inadequacy of financing are numerous, including owners' lack of capital to cover high upfront costs of EE investments, lack of awareness on the financial benefits of the investments, fear of hidden costs, uncertainty regarding the precise nature of energy savings, high transaction costs, difficulties in separating operating and capital budgets and others. In the Arab region the problem of lack of adequate financing is further complicated by heavily subsidized energy prices. EE investments can appear unattractive when business cases assume continued low energy prices, especially in the residential sector.

Financial instruments are designed to encourage EE investments either through reducing the costs associated with investments or rewarding efficient use of energy (ICER, 2010). There are two types of financial instruments: direct economic incentives and indirect fiscal measures. Economic incentives include grants, various subsidy schemes and soft loans. The main purpose of these incentives is to help to overcome the initial high upfront costs of EE investments by reducing the price of EE equipment or labor (World Energy Council, 2008). Grants and subsidies are usually given directly to the party implementing energy efficiency projects (ICER, 2010).

Results of assessment

In the region, many countries have established, or are in the process of establishing EE funds to administer various subsidy schemes for EE projects. EE funds *per se* do not ensure financing of EE projects, however, they are helpful in mobilizing all existing funds and streamlining financing activities. Table 18 illustrates the status of EE funds in the region.

Table 18: EE funds in RCREEE member states

Country	EE Fund	Source of Financing
Algeria	National Fund for Energy Management (FNME) established by Decree 2000-116 with annual capital of EUR 57 million	- Taxes on natural gas (DA 0.0015/Btu) and electricity (DA 0.02/ kWh) - Initial government contribution of DA 100 million (EUR 1.15 million)
Bahrain	None	
Egypt	None	
Iraq	None	
Jordan	Jordanian Renewable Energy and Energy Efficiency Fund (JREEEF)	- Annual budget allocations - Foreign donations
Lebanon	National Energy Efficiency and Renewable Energy Action (NEEREA) established by Central Bank of Lebanon in 2010	- EUR 12 million from EU grant for RE projects - Central Bank of Lebanon (low interest soft loans)
Libya	None	
Morocco	Energy Development Fund (EDF) with a total capital of one billion USD	- USD 200 million from Hassan II fund - USD 300 million from UAE - USD 500 million from Saudi Arabia
Palestine	Revolving Fund for EE projects (ESCO model)	- Start-up capital from donor institutions - Funds saved through EE projects
Sudan	None	
Syria	None	
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 savings achieved as a result of EE activities - Private donations
Yemen	None	

Source: RCREEE focal points, RCREEE Energy Efficiency Country Profiles (2013)

Unlike subsidies, fiscal measures encourage EE investments not through reducing the upfront payment, but through reducing the overall costs of EE investments. The typical approach of fiscal measures is to reduce the amount of tax that consumers must pay in undertaking EE improvements. Such measures include tax credits, tax deductions, tax reductions, tax exemptions and others (World Energy Council, 2008).

As an example, Table 19 shows that the region, on average, maintains relatively high customs duties on importing compact fluorescent lamps (CFLs) and solar water heaters (SWHs). This does nothing to increase the attractiveness of these technologies where no tax concessions exist.

Table 19: Customs duties on CFLs and SWHs

Appliance	Algeria	Bahrain	Egypt	Iraq	Jordan	Lebanon	Libya	Morocco	Palestine	Sudan	Syria	Tunisia	Yemen
CFLs (%)	30	5	17	15	0	5	5	2.5	8	20	5	15	5
SWHs (%)	30	5	2.5	15	5	5	5	2.5	0	20	30	27	5

Source: WTO (2012), national customs authorities (2012)

4.4 Rank under Policy Framework Category

Tables 20 and 21 present final scores under the Policy Framework category. As can be observed, many countries still need to improve their regulatory frameworks. The only country that stands out with an impressive EE regulatory framework is Tunisia. Tunisia has had a NEEAP with specific targets since 2004 covering not only electricity, but other forms of energy as well. It has adopted a comprehensive regulatory framework covering all aspects of the economy: residential, tertiary, industrial, utility, lighting, buildings and appliances. It has adopted not only necessary policies, but also monitored the results and accordingly amended, adjusted and tightened EE requirements periodically, achieving continued improvement. In contrast, some countries in the region such as Libya and Yemen have almost no EE regulations. These countries still have a long way to go in pursuing the path to EE.

The industrial sector in the region appears to be the least regulated. Of 13 countries, only three have legislation encouraging EE in the industrial sector, and only one of these three has an effective energy efficiency regulatory framework. The industrial sector presents ample opportunities for EE improvements, constitutes relatively smaller numbers of customers and represents a substantial part of the economy. It appears wise to focus more attention on this sector.

Table 20: Final scores under Policy Framework category - Energy strategy, EE targets and EE regulations

	Energy Strategy	EE Targets (NEEAPs)			EE Regulatory Framework			
		Residential	Industrial	Utility	Framework legislation	Buildings	Appliances	Industry
Algeria	55	10	10	10	100	70	64	55
Bahrain	10	10	10	10	10	70	28	10
Egypt	10	100	10	55	55	70	100	10
Iraq	55	10	10	10	10	40	10	10
Jordan	100	10	10	10	100	100	64	10
Lebanon	55	55	70	10	55	40	55	10
Libya	10	10	10	10	10	10	10	10
Morocco	100	10	10	10	100	40	10	10
Palestine	100	100	70	100	10	40	10	10
Sudan	10	100	70	100	10	10	10	10
Syria	10	10	10	10	100	70	28	33
Tunisia	100	100	100	100	100	100	82	100
Yemen	55	10	10	10	10	10	10	10

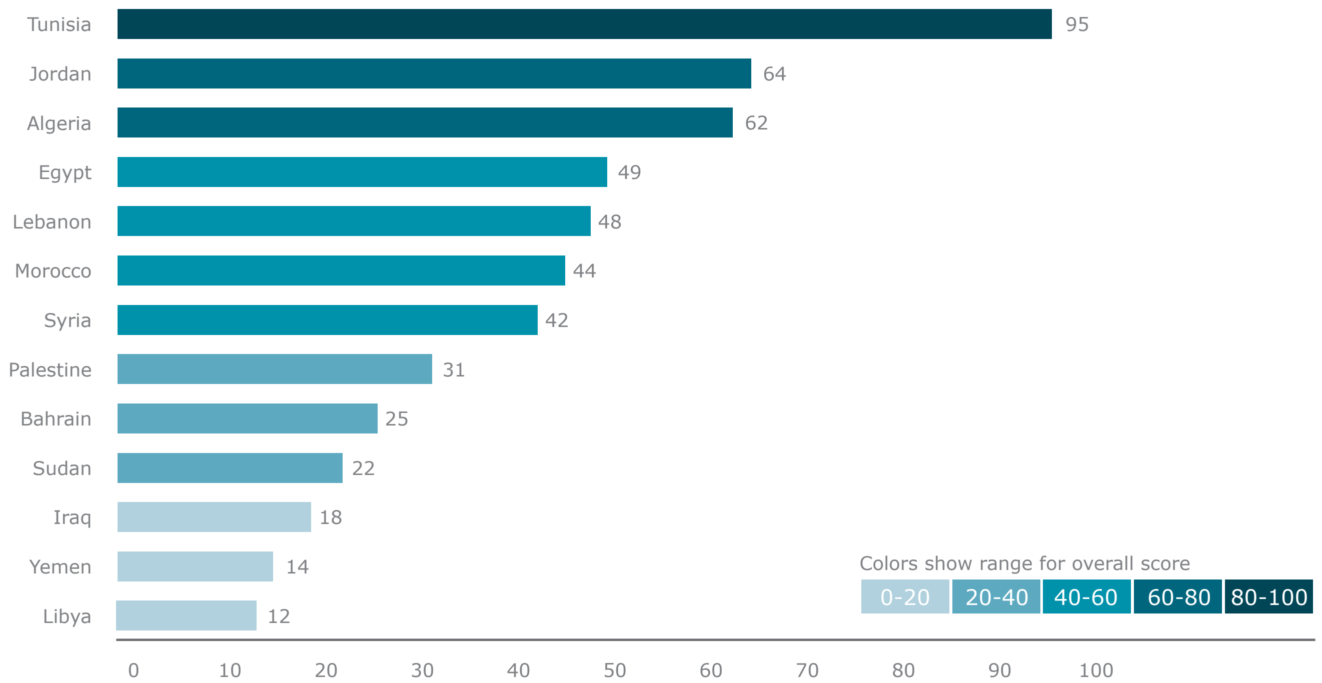
Table 21: Final scores under Policy Framework category - financial incentives

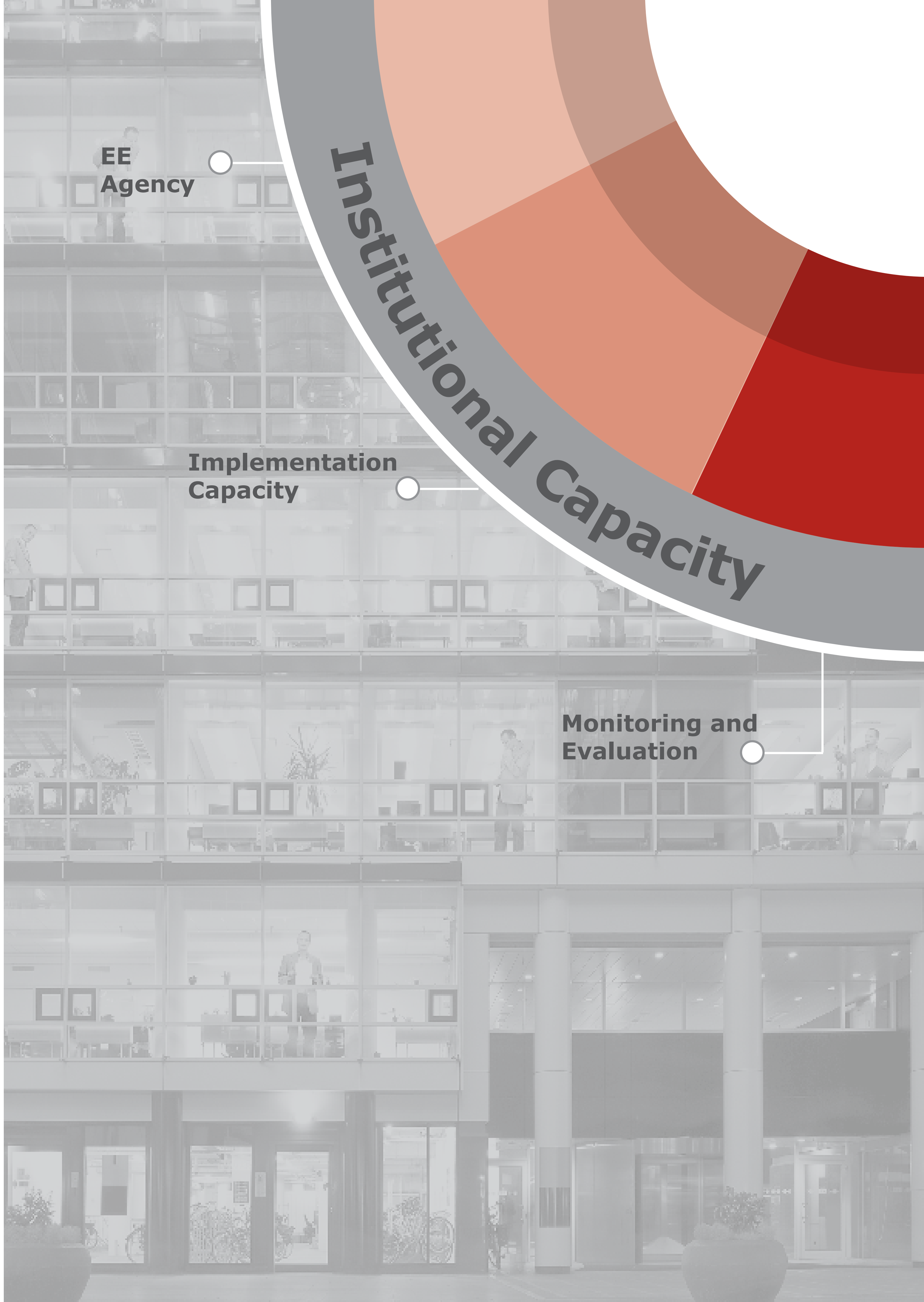
	EE Fund and Tax Exemptions	Customs Duty for SWHs	Customs Duty for CFLs
Algeria	70	10	10
Bahrain	10	85	85
Egypt	10	93	49
Iraq	10	55	55
Jordan	70	85	100
Lebanon	70	85	85
Libya	10	85	85
Morocco	70	25	93
Palestine	10	100	76
Sudan	10	70	70
Syria	10	10	85
Tunisia	100	19	55
Yemen	10	85	85

Figure 9 presents final scores and ranks under the Policy Framework category. Due to its comprehensive legal framework Tunisia ranks first, while Libya ranks last. Jordan comes second because it has recently made substantial efforts in adopting EE regulations. As such, Jordan has adopted a Renewable Energy and Energy Efficiency Law, a bylaw implementing the law, EE building code, statutory obligation to install solar water heaters, and a full exemption from customs duties and sales taxes for EE equipment. It is currently finalizing its first NEEAP. Algeria has had a comprehensive regulatory framework covering almost all aspects of the economy since the early 2000s, however, weak implementation remains the main problem in the Algerian case and prevents the country from capitalizing on its EE regulations.

The assessment reveals a lack of coherence between various policies; for example almost all countries have a policy of energy efficient lighting distribution at reduced costs, whereas the customs duty for these products remains high. These two policies do not complement each other. Generally speaking; countries need to consider the sum of the results of their chosen policies.

Figure 9: Final scores and ranks under Policy Framework





5. Category 3: Institutional Capacity

The Institutional Capacity category assesses the capacity of states to formulate and successfully implement EE policies. Strong institutional capacity is critical to ensuring the effectiveness of EE policies and programs. It consists of three factors: (1) EE agency; (2) implementation capacity; and (3) monitoring and evaluation. The factors and the indicators that inform them are described in Table 22. The last factor, monitoring and evaluation, is not assessed this year due to lack of data, but it will be included in the assessment for the next edition of AFEX Energy Efficiency.

Table 22: Institutional Capacity

Category	Factors	Indicator	Score/Measuring Unit
Institutional Capacity	EE agency	Designated EE agency	Expert assessment from 0 to 10 based on: presence of designated EE agency; adequacy of technical and human resources; capacity to formulate and implement EE policies
	Implementation capacity	Number of EE building built	% of new building stock
		Solar water heater diffusion rate	m^2 of panels per 1,000 inhabitants
		Number of demonstration projects	Expert assessment from 0 to 10 based on number of demonstration projects; market size of construction industry
		Number of CFLs distributed	% of residential customers
		Number of energy audits conducted in residential/tertiary sectors	Expert assessment from 0 to 10
		Number of energy audits conducted in industrial sector	Expert assessment from 0 to 10
		Corruption Perception Index	CPI scores
	Monitoring and evaluation		

5.1 Designated EE Agency

Why this indicator?

A designated EE agency constitutes "the heart of any system of energy efficiency governance", the structure and design of which ought to be carefully considered (IEA, 2010). An EE agency should be a dedicated body with a strong capability to design, formulate, implement, and evaluate EE policies and programs. It should also be capable to coordinate activities among various stakeholders and government institutions to ensure more efficient use of existing human, capital and technical resources in achieving EE objectives (World Energy Council, 2008). This factor has been assessed by an expert survey based on three criteria: (1) the actual existence of a dedicated body responsible for developing and implementing EE policies and programs; (2) human, financial and technical capacity of the agency; and (3) the output of the agency in terms of policy formulation and implementation.

Results of assessment

In RCREEE member states, almost half of the countries have established dedicated EE agencies, however these institutions vary greatly in their technical and human capacities. Table 23 presents in more detail the EE institutional capacity of RCREEE member states.

Table 23: Dedicated EE agencies

	Dedicated Agency for Formulating and Implementing EE Policies
Algeria	National Agency for the Promotion and Rationalization of Use of Energy (APRUE)
Brief Description:	APRUE was established in 1985, with current staff of around 50 people. Main activities of APRUE include: - Implementation of program Eco-Lumiere: distribution of one million energy efficient light bulbs (CFLs). - Implementation and follow-up on National Program on the Rationalization of Use of Energy (PNME) for 2011-2013, which includes activities on thermal insulation of buildings, development of solar heating, widespread use of energy efficient light bulbs, introduction of EE in public lighting, introduction of EE in the industrial facilities, increased use of LPG and pilot projects on solar cooling. - Funding EE projects through the FNME (Fond National pour la Maîtrise de l'Energie) mainly through giving credits, soft loans and loan guarantees.
Supporting Energy Research Institution	- Algerian Institute for Renewable Energy and Energy Efficiency (IAEREE). - Center of Research and Development on Electricity and Gas (CREDEG).
Morocco	National Agency for the Development of Renewable Energy and Energy Efficiency (ADEREE)
Brief Description:	ADEREE was established in 1982, with current staff of around 131 people. Main activities include: - Developing a program to improve EE in the building sector. The program benefits from EUR 10 million of financial support from the EU Commission to demonstrate EE measures. ADEREE completed the first stage of the program on the development of technical specifications for thermal regulations for buildings, estimating potential socio-economic, environmental and energy impact of thermal regulations. Currently, nine demonstration projects are currently under construction in six climatic zones in Morocco. - Implementing a program to encourage EE in the industrial sector (PPEI), which includes various EE measures targeting 360 companies. - Preparing minimum energy performance standards with appropriate labeling schemes for refrigerators and air conditioners - International cooperation, particularly with the AACID (Agence Andalouse de Coopération Internationale au Développement) and the Junta de Andualucia (Spain) on the implementation of two projects related to electrification of rural schools with PV, replacing inefficient light bulbs, installation of solar water heaters in public buildings, hospitals and schools.
Supporting Energy Research Institution	- National Center for Scientific and Technical Research (CNRST).
Tunisia	National Agency for Energy Management (ANME)
Brief Description:	ANME was established in 1986, with current staff of around 135 people. Main activities of ANME include various initiatives in all economy sectors: - Participate in the creation and implementation of national EE programs with the following main actions: compulsory and periodic energy audits, prior consultation for projects that consume a significant amount of energy, co-generation, labeling of equipment and apparatus, thermal regulation for buildings, rational energy use in public lighting, diagnostics of automotive engines, mobility plans for large cities, RE promotion and energy substitution. - Propose legislation and conduct studies such as a strategic study on EE in 2005; information system on the rationalization of the use of energy and environment in 2006; the study of co-generation development and tri-generation in Tunisia; the study of EE development in agriculture and fishing sectors; study on the energy and thermal retrofitting of existing buildings; the study of RE generation by 2030 and the inventory of GHG emissions due to energy and industrial processes. - Managing the national fund for the rationalization of energy use, aiming at incentivizing EE. - Technical demonstration and support of R&D through the Federated Research Projects (Projets de Recherche Fédérés - PRF) namely the PRF solar heating, PRF solar desalination techniques mastering, PRF solar cooling and PRF solar drying for agricultural products.
Supporting Energy Research Institution	- Mechanical and Electrical Industries Technical Center (CETIME) - Technical Centre for Wood Industry and Furniture (CETIBA) - Technical Centre for Building Materials, Ceramics and Glass (CTMCCV) - Construction Testing and Techniques Center (CETEC)

Syria	National Energy Research Centre (NERC)
Brief Description:	NERC was established in 2003, with current staff of around 60-65 people. NERC is government-owned institution, financed through a separate budget line from the Ministry of Finance. Main activities of NERC in the field of EE include: - Implementation of the Energy Conservation Law (2009). - Developing testing protocols for EE appliances. - Trained more than 1,000 engineers to interpret and implement thermal insulation code for buildings (2009). - Undertaking energy audits in industrial and large energy consuming facilities.
Supporting Energy Research Institution	- Scientific Studies and Research Center - Industrial Research and Testing Center - Research Centers in the Faculty of Engineering, Damascus University - The Higher Institute for Applied Sciences and Technology
Palestine	Palestinian Energy Authority (PEA)
Brief Description:	PEA was established in 1995, with current staff of around 20 people. Main activities of PEA include: Implementation of project on "Promotion of EE and RE in Strategic Sectors", launched in 2009, supported by French Development Agency and the French Global Environment Facility. Main purpose of the project is to implement various EE measures prescribed in NEEAP (2011-2013).
Supporting Energy Research Institution	Palestinian Energy and Environment Research Center (PEC) Energy Research Centre (ERC) at An-Najah National University
Lebanon	Lebanese Center for Energy Conservation (LCEC)
Brief Description:	LCEC was established in 2002, with current staff of around 8, plus 10 on affiliated projects, and 12 on a project/activity basis. Main activities of LCEC include: - Preparation and implementation of Lebanon's first National Energy Efficiency Action Plan (NEEAP), which includes 14 EE measures in various sectors of economy. - Implementation of various EE pilot projects including replacement of 1,048 CFLs in the village of Niha in the Bekaa area in collaboration with Electricité de Zahlé (EDZ). - Conducting studies on assessing the Lebanese market of energy conservation. - Launching an energy audit program to assist customers in commercial, public buildings and industrial plants in the management of their energy.
Supporting Energy Research Institution	- The Industrial Research Institute (IRI) - National Council for Scientific Research (CNRS) - The Lebanese Standards Institution (LIBNOR) - Energy Research Group at the American University of Beirut - Lebanese Association for Energy Management (ALMEE)
Dedicated EE Department within the Ministry	
Jordan	Energy Efficiency Department at the Ministry of Energy and Mineral Resources.
Brief Description:	The Department currently has staff of around 5 people. Main activities of the Department include: - Preparation of Jordan's first NEEAP. - Implementation of EE laws and regulations.
Supporting Energy Research Institution	- National Energy Research Center (NERC) established in 1999, currently has staff of around 30 people.
Bahrain	Electricity and Water Conservation Directorate at the Electricity and Water Authority
Brief Description:	Electricity and Water Conservation Directorate with current staff of 45 with 9 people working in Electricity Conservation Department.
Supporting Energy Research Institution	Information is not available.
EE as an Auxiliary Function of Another Department	
Egypt	EE Unit at the Council of Ministers Secretariat
Brief Description:	The EE Unit currently includes staff of one person only. EE Unit does not have policy formulation powers; its activities are mainly limited to coordination of various EE activities and implementation of selected measures under Egypt's first NEEAP.
Energy Research Institution	- Academy of Scientific Research and Technology (ASRT) - Energy Research Center, Cairo University (ERC) - Egypt National Cleaner Production Center (ENCPC)
Libya	Renewable Energy Authority of Libya (REAOL)
Brief Description:	Main activities of REAOL in the field of EE include preparation of Libya's first NEEAP.
Energy Research Institution	None.

Iraq	Working Group on EE at the Ministry of Electricity
Brief Description:	Working group is currently composed of 10 members from various Departments within the Ministry of Electricity.
Supporting Energy Research Institution	Research Center for Energy and Environment under Ministry of Science and Technology Research Center under Ministry of Higher Education and Scientific Research (universities and institutes) Renewable Energy and Environment Research Center under Ministry of Industry
Sudan	Electricity Regulatory Authority (ERA)
Brief Description:	Activities of ERA in the field of EE include: Preparation and implementation of Sudan's first NEEAP, which includes around 23 EE measures in all sectors of economy with a focus on EE in power generation, transmission and distribution.
Supporting Energy Research Institution	National Center for Energy Research (NCR)
Yemen	Ministry of Electricity and Energy

Source: RCREEE focal points, RCREEE technical experts, PWMSP (2012), AREED (2011)

5.2 Implementation Capacity

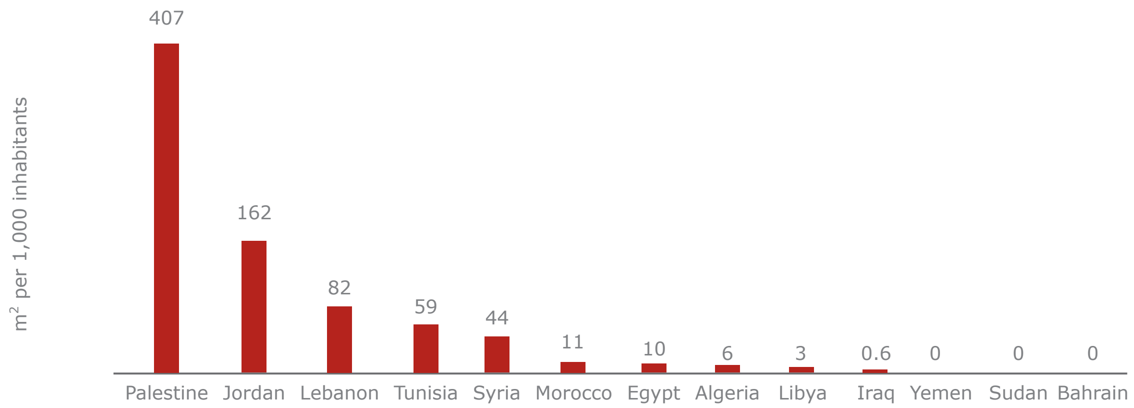
Implementation capacity is an essential attribute of the EE agency. EE measures can be effective only if they are successfully implemented, and this refers especially to mandatory EE regulations. Ensuring strong compliance and enforcement is a difficult task and requires complex activities including those aimed at encouraging the compliance rate (capacity building programs, demonstration projects, financial incentives and others), a clearly prescribed and transparent enforcement procedure, adequate financial and human resources of the enforcement agency and others (Feng Liu, 2010). Similarly, measuring implementation capacity is a challenging task due to many economic and political influencing factors.

In AFEX Energy Efficiency, implementation capacity is measured by six indicators: (1) rate of solar water heater diffusion measured by square metres installed per 1,000 inhabitants; (2) number of buildings built according to EE regulations for buildings, which is measured as percentage of new building stock; (3) number of incandescent light bulbs replaced by energy efficient lighting technology such as CFLs measured as percentage of residential and tertiary customers; (4) number of demonstration projects built in order to raise awareness and enhance capacity of the construction industry; (5) number of energy audits conducted in residential and tertiary sector; and (6) number of energy audits conducted in the industrial sector.

5.2.1 Diffusion of Solar Water Heaters

Diffusion of SWHs in the region still remains relatively low with the exception of Palestine. In Palestine, almost 70% of households are equipped with SWHs. Such a high penetration rate of SWHs is mainly a response to persistently high energy prices (gtz, 2009). Figure 10 illustrates the rate of SWH diffusion in RCREEE member states. The indicator is measured as the ratio of square metres of water heating panels installed per 1,000 inhabitants within a country.

Figure 10: Diffusion rate of solar water heaters in RCREEE member states (2012)



Source: RCREEE focal points (2012), MEDENER

Although the tourism sector has high potential for SWH installations, in general the diffusion of SWHs in the residential sector remains much higher than in tertiary or commercial sectors. The main barriers to the diffusion of SWHs include high upfront costs of equipment compared to consumer purchasing power, lack of financial incentives, and inadequate quality control infrastructure that leads to entry of low quality products into the market, subsequently resulting in negative experiences (GTZ, 2009; Orrling et al, 2013).

5.2.2 EE Buildings

The construction industry, or building sector, is the sector where implementation capacity is most lacking. Although more than half of RCREEE member states adopted some sort of EE regulations for buildings, the main problem remains almost complete lack of their enforcement.

As can be observed in Table 24, compared to total new buildings built every year, the number of EE buildings built is negligible. Responsibility for enforcement usually lies with municipalities, which often lack financial and human capacity to properly inspect and review site plans, building designs and construction sites. Designing, constructing and renovating buildings according to EE specifications requires upgrading skills, knowledge and expertise of professionals in the building sector – including architects, designers, contractors, installers and others – which is currently still lacking in most of the region. Some efforts have been made in this direction through demonstration building projects (noted in Table 24), but again these activities are still not sufficient and more efforts need to be put into strengthening the implementation capacity.

Table 24: Status of enforcement of EE building codes in RCREEE member states (2012)

	New Buildings Built Every Year	Number of Buildings Built According to EE Building Code	Number of Demonstration Projects
Algeria	80,000[5]	None/nearly none	600 housing units are currently under construction under ECO-BAT program
Bahrain	6,000[6]	81	-
Egypt	69,030[7]	None/nearly none	None
Iraq	22,000	None/nearly none	None
Jordan	20,000	None/nearly none	11
Lebanon	n/a	None/ nearly none	5 real estate projects
Libya	50,000	No EE code	None
Morocco	170,000	None/nearly none	9 buildings are currently under construction in six climatic zones of Morocco
Sudan	n/a	No EE code	None
Syria	30,000	None/nearly none	4
Tunisia	60,000	4,681 (administrative) 14,724 (residential)	43 pilot projects have been constructed under RTEBNT program
Palestine	n/a	None/nearly none	1
Yemen	n/a	No EE code	None

Source: RCREEE focal points

5.2.3 EE Lighting

Current market share of EE lighting technology such as CFLs is unknown because there is no true market monitoring. However, unofficial expert assessments conclude the use of incandescent light bulbs continues to dominate. It is estimated that the penetration of CFLs in most of the developing countries remains relatively small, at no more than 10% to 15% (Dilip R. Limaye, 2009). In the region, the preferred choice for promoting EE technology so far has been bulk distribution of CFLs at low or no cost. Table 25 illustrates the number of CFLs distributed from 2009 to 2012. The preferred choice so far has been CFL, but there are efforts now to promote LED technology as well.

5 The number represents current national capacity for construction of new housing units. In 2013, the Algerian government plans to increase this number to 800,000 to meet its goal of 1.2 million new units by 2014 http://magharebia.com/en_GB/articles/awi/features/2012/12/14/feature-03

6 6,000 housing units were built in 2011 and 7,000 were expected to be completed in 2012 http://www.oxfordbusinessgroup.com/economic_updates/bahrain-housing-push-expand-construction-sector

7 http://www.capmas.gov.eg

Table 25: Number of CFLs distributed in RCREEE member states (2009 to 2012)

	Number of CFLs Distributed (2009 to 2012)	Number of Residential Customers
Algeria	500,000	6,118,000
Bahrain	0	226,000
Egypt	10,250,000	19,464,000
Iraq	5,000,000	3,080,000
Jordan	0	1,346,000
Lebanon	3,090,000	1,327,000
Libya	0	903,000
Morocco	8,000,000	3,964,000
Sudan	0	1,546,000
Syria	10,000	4,543,000
Tunisia	8,900,000	2,814,000
Palestine	5,000	302,000
Yemen	0	1,473,000

Source: RCREEE focal points, Arab Union of Electricity (2012)

5.2.4 Energy Audits

The energy audit is a basic and effective tool in pursuing a comprehensive energy efficiency program. It allows identification of various conservation and EE improvements that can be made in a specific facility ranging from no- or low-cost quick improvements to more complex solutions involving upgrading equipment or changing technology. Typically an energy audit consists of verification, monitoring and analysis of the energy consumption, followed by a report with recommendations, and, depending on the scope of the audit, the report can contain detailed recommendations with cost-benefit analysis and a specific action plan (ICER, 2010). Energy audits on their own do not necessarily lead to reduction of energy consumption, but they are critical in pursuing EE improvements.

Table 26 shows the approximate number of energy audits conducted in countries during the period from 2010 to 2012. Although these numbers do not represent the overall amount of audits conducted per country, compared to the number of electricity customers they do provide a general picture of low demand for pursuit of EE and provide a useful metric.

Table 26: Number of energy audits by sector (2010 to 2012)

Country	Number of Energy Audits Conducted in Residential and Tertiary Sector	Number of Customers		Number of Energy Audits Conducted in Industrial Sector	Number of Customers in Industrial Sector
		Residential	Tertiary		
Algeria	0	6,118,000	661,000	17	145,000
Bahrain	19	226,000	80,000	0	1,000
Egypt	40	19,464,000	1,617,000	268	665,000
Iraq	0	3,080,000	529,000	0	16,000
Jordan	6	1,346,000	196,000	80	16,000
Lebanon	11	1,327,000	-	22	8,000
Libya	0	903,000	125,000	0	56,000
Morocco	16	3,964,000	401,000	52	38,000
Palestine	18	-	-	12	-
Sudan	0	1,546,000	179,000	0	1,000
Syria	8	4,543,000	826,000	46	77,000
Tunisia	74	2,814,000	361,000	91	47,000
Yemen	2	1,473,000	213,000	1	2,000

Source: RCREEE focal points, Arab Union of Electricity (2012)

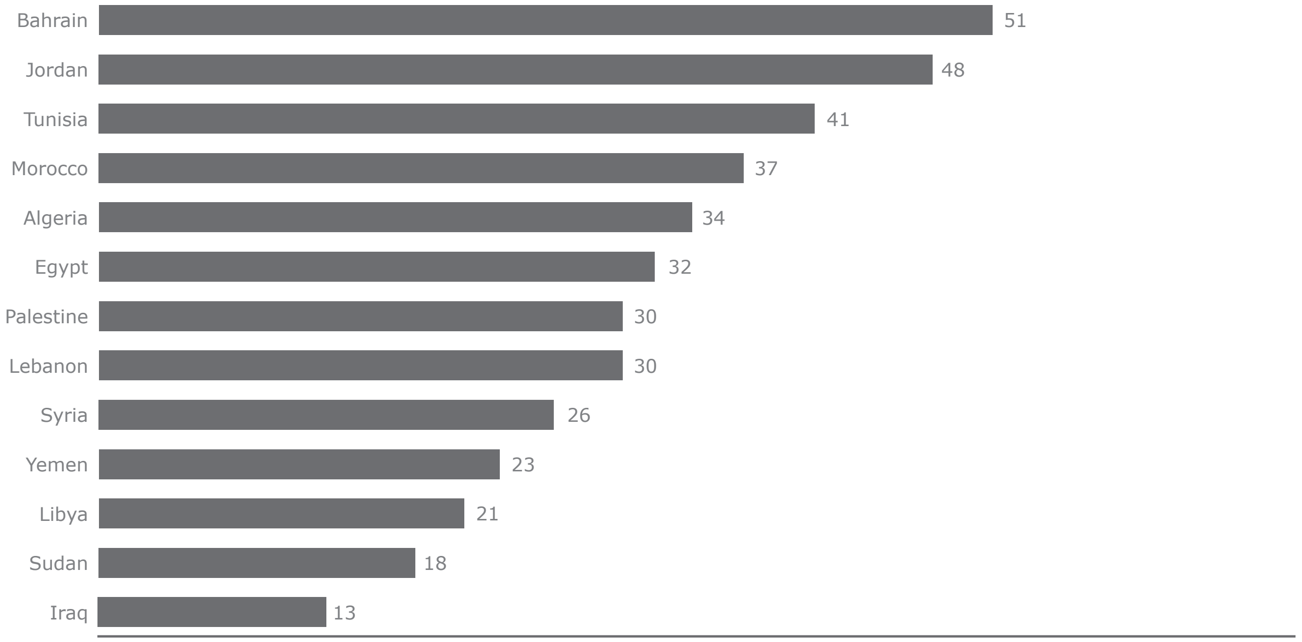
http://www.transparency.org

5.2.5 Corruption Perception Index

In general, reasons for weak enforcement mechanisms are numerous, including corruption, weak institutional capacity, under-funding, lack of technical capacity to carry out proper inspections and supervision of construction projects and others (Feng Liu, 2010). In order to measure the effectiveness of enforcement systems, the results of an existing global initiative on this issue are used: the Corruption Perception Index by Transparency International.

Corruption Perception Index (CPI) developed by Transparency International, the global coalition against corruption, measures the perception of corruption in the public sector, which includes public officials, civil servants and politicians. Corruption is interpreted as an abuse of entrusted power for private gain. It is based on the results of the questionnaires on bribery of public officials, kickback in public procurement, embezzlement of public funds, and efforts to fight against corruption. Information is drawn from 17 data sources at 13 institutions and claims to be of the highest quality. CPI is a well-known and widely trusted index. It has existed since 1995. The CPI index methodology can be found on the Transparency International web site[8] . The scores of RCREEE member states in the 2012 CPI are shown in Figure 11.

Figure 11: Corruption Perception Index (2012)



Source: Transparency International (2012)

5.3 Rank under Institutional Capacity Category

Table 27 presents final scores under the Institutional Capacity category. Institutional capacity in the region as a whole is rather weak, again with the exception of Tunisia. Relatively successful implementation of EE measures in Tunisia is mostly attributed to the strong dedicated EE agency, ANME, which has done an excellent job in demonstrating strong public commitment for EE.

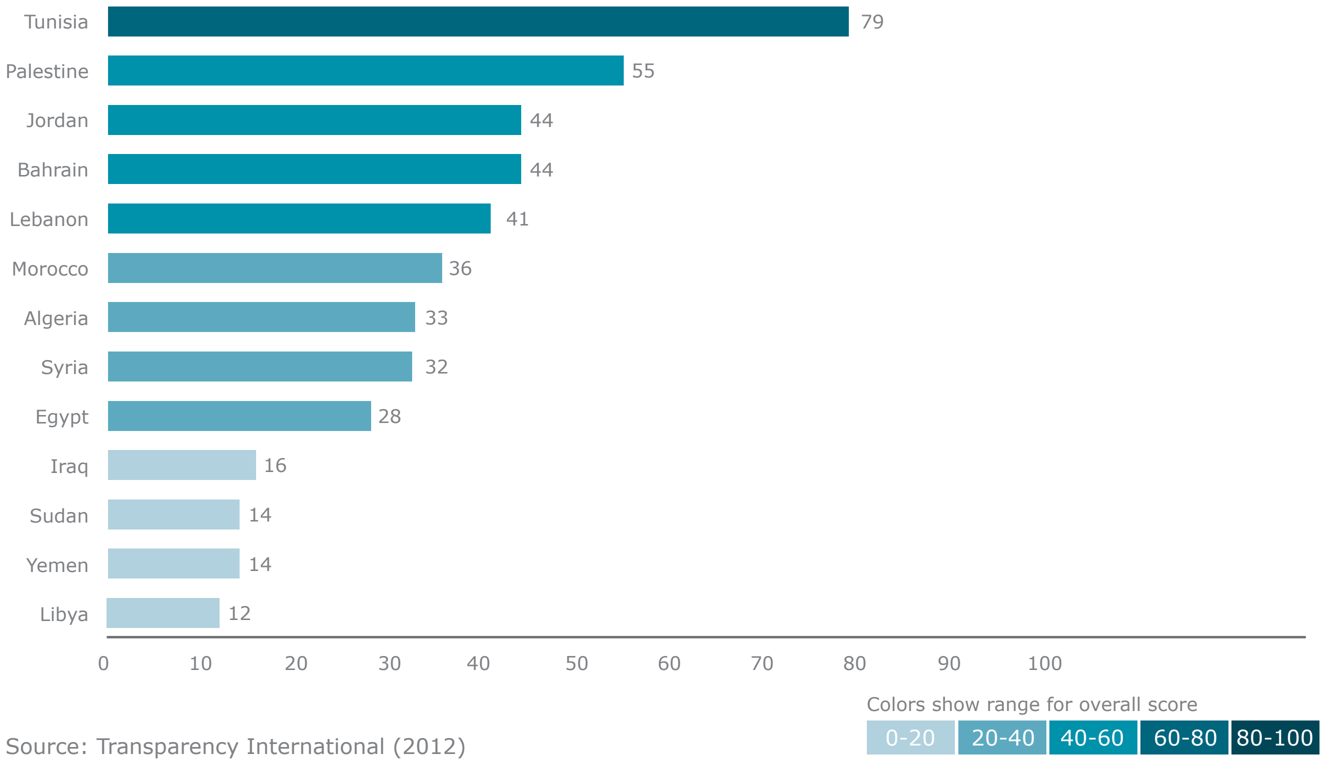
Table 27: Final scores under Institutional Capacity category

	EE Agency	SWH Diffusion Rate	EE Buildings	Demonstration Projects	Number of CFLs Distributed	Energy Audits Residential	Energy Audits Industrial	CPI
Algeria	64	11	10	63	12	10	33	60
Bahrain	32	10	55	100	10	80	10	100
Egypt	45	12	10	21	25	55	69	55
Iraq	18	10	10	10	56	10	10	22
Jordan	48	46	10	74	10	49	91	93
Lebanon	64	28	10	47	76	69	55	50
Libya	10	11	10	10	10	10	10	29
Morocco	56	12	10	31	67	69	69	67
Palestine	67	100	10	42	10	94	62	50
Sudan	29	10	10	10	10	10	10	10
Syria	64	20	10	42	10	35	55	41
Tunisia	100	23	100	100	100	100	100	76
Yemen	10	10	10	10	10	35	39	34

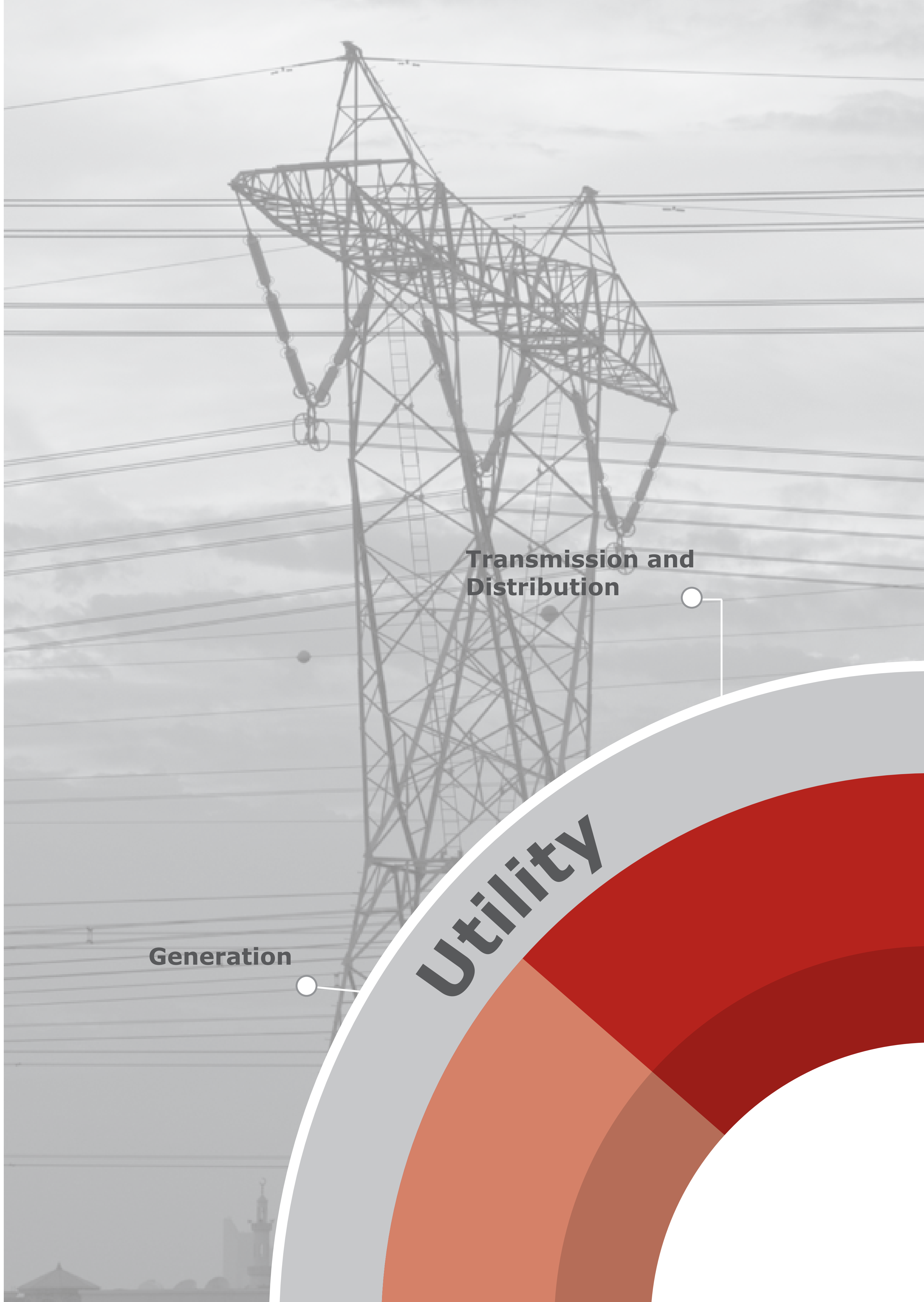
Figure 12 reports final scores and ranks under the Institutional Capacity category. Tunisia clearly leads in this category, with Palestine also standing out from the pack. Several countries are virtually tied in their scores. There is a tie for third spot between Jordan and Bahrain. The next group of countries with close results is Algeria and Syria.

The last group of countries with close results is Iraq, Sudan, Yemen and Libya. These ties or close results indicate that these countries are very similar in their performance and any small improvement in one of the indicators will have an impact on the rank for next year's AFEX Energy Efficiency results.

Figure 12: Final scores and ranks under Institutional Capacity category



Source: Transparency International (2012)



6. Category 4: Utility

Energy saving measures from the utility sector are crucial in achieving a reduction in resource consumption, while saving money and reducing environmental impact. This is especially relevant when the generation, transmission and distribution of electricity is largely state-owned and state-administered, which is the case in most countries of the region. To make gains, EE obligation schemes have to be seen by utility companies as opportunities for business development, for improving competitiveness, and for making progress towards goals of the state. Furthermore, helping consumers to reduce their electricity bills is also a function of EE achievements by utilities with an obvious direct and indirect social impact.

As defined in Table 28 below, the Utility category consists of two factors only: (1) generation; and (2) transmission and distribution. Generation is measured by two indicators: share of renewable energy and power generation efficiency; and the transmission and distribution factor is measured by one indicator: percentage of losses in the transmission and distribution networks.

Table 28: Utility

Category	Factors	Indicator	Score/Measuring Unit
Utility	Generation	Share of renewable energy in generation mix	% (MW installed capacity)
		Power generation efficiency	%
	Transmission and distribution	Transmission and distribution losses	%

6.1 Power Generation

6.1.1 Share of Renewable Energy

Why this indicator?

Renewable energy presents a number of benefits for the energy system in general: conserving the depleting supply of fossil fuel; reducing negative environmental impacts from use of fossil fuel; and achieving greater energy security in the long-term by reducing dependency on fossil fuel and diversifying supply options. In power generation the pursuit of renewable energy also reduces the amount of fossil fuel necessary for conversion of primary energy to electricity. For example, a typical coal-fired power station needs 2.9 kWh of primary fossil energy for every kWh of electricity generated, whereas hydro uses only 0.02 kWh of fossil energy per kWh of generation (Green Rhino Energy, 2013).

Results of assessment

In the region, electricity generation continues to be dominated by fossil fuels, with renewable energy being almost negligible. Figure 13 illustrates the share of renewable sources as a portion of installed generation capacity. The lowest shares are observed in Bahrain, Libya, Yemen, Jordan and Palestine (less than 1% share) and the highest shares for Sudan and Morocco (58.4% and 33.1% respectively). Sudan generates the majority of its electricity from hydro power with no other renewable sources reported. Morocco's RE installed base is also dominated by hydro (27.2%), followed by wind (5.2%). With these successes in mind, hydro generation is mature and nearly fully exploited in the region, so new RE generation will generally need to come from other sources.

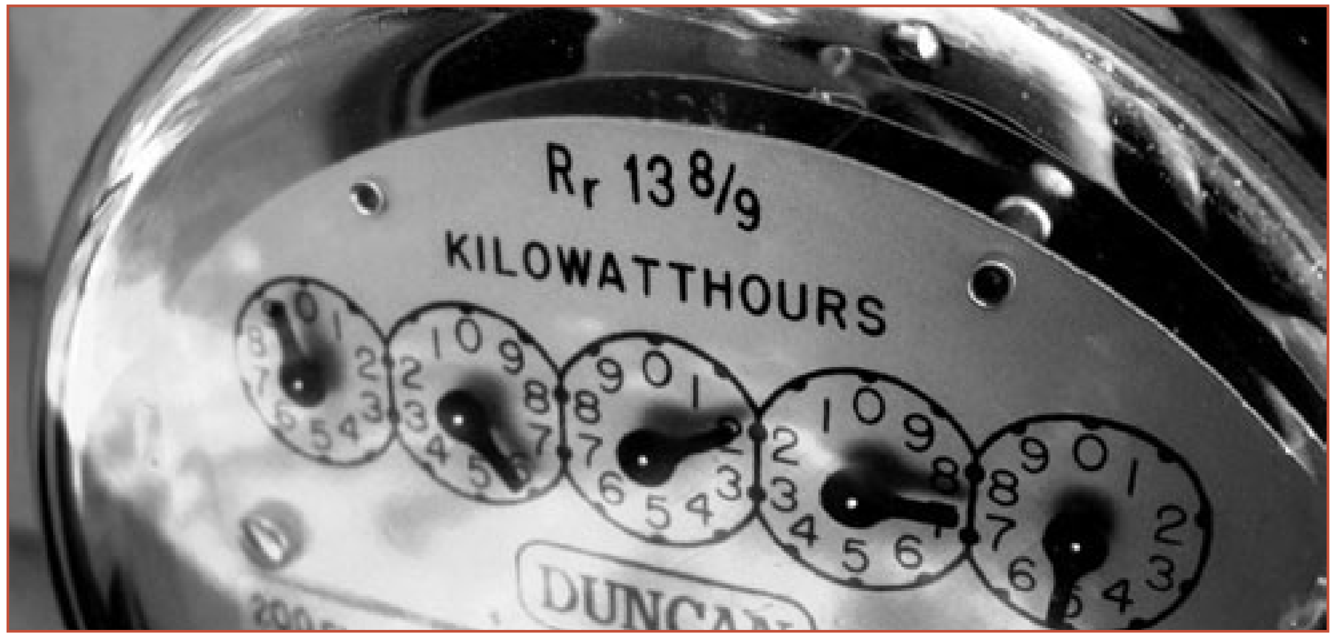
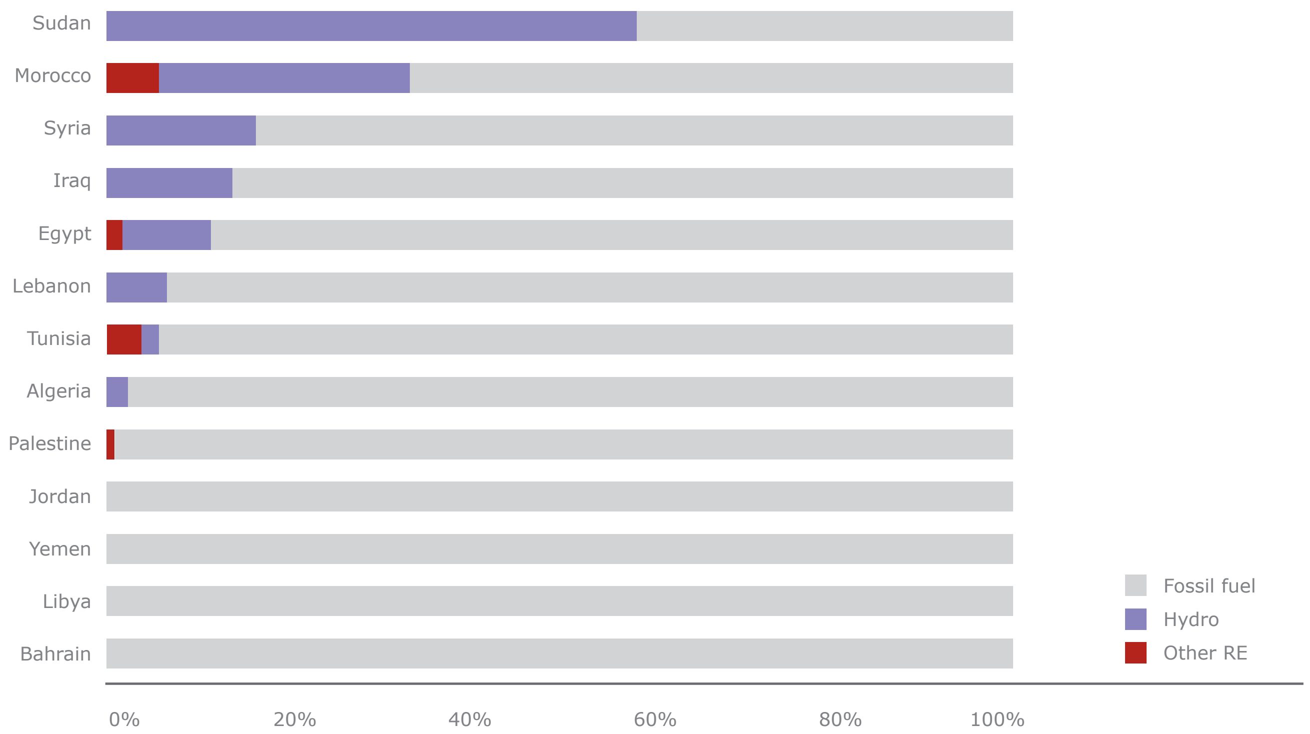


Figure 13: Share of renewable energy (% of installed capacity, 2012)



Source: Arab Union of Electricity (2011), RCREEE focal points, RCREEE Renewable Energy Country Profiles (2013)

The share of renewable energy indicator excludes hydro power from the scoring process. This focuses the results upon the remaining renewable energy types that still have potential for growth in the region.

6.1.2 Power Generation Efficiency

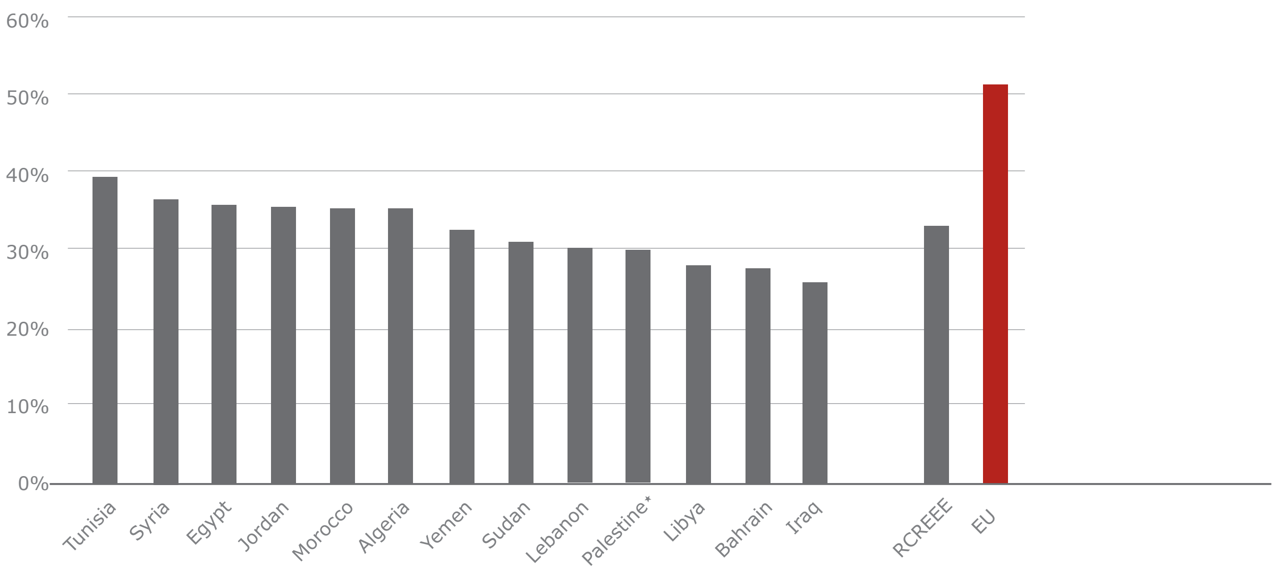
Why this indicator?

Power generation efficiency refers to the efficiency of thermal plants. It is measured as the ratio between total electricity generated by thermal plants and fuel input. A higher efficiency indicates more effective use of fuel in generating electricity, thus has a direct impact on EE. Power generation efficiency depends on a number of factors such as generation technology, age of the power plants, fuel mix for power generation, efficiency of plant operation and maintenance and others (Missaoui et al, 2012).

Results of assessment

Figure 14 indicates the current state of power generation, with efficiency ranging from 26% (Iraq) to 39% (Tunisia), with an average of 33%. Although the generation mix varies throughout the region, the overall efficiencies are not highly variable, indicating a generally low level of efficiency in producing electricity for the region's generators compared to the 51.2% average power generation efficiency in Europe.

Figure 14: Power generation efficiency in RCREEE member states (2009)



*Palestine value uses Arab average

Source: RCREEE based on data from national authorities

6.2 Transmission and Distribution Losses

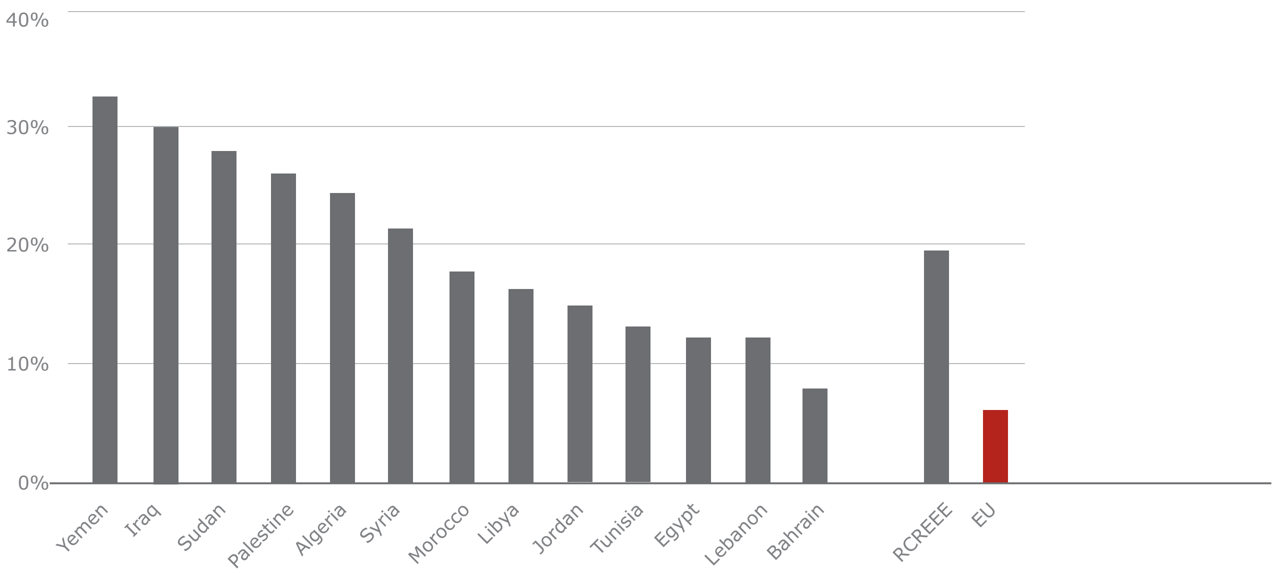
Why this indicator?

Reducing losses during power transmission and distribution has a direct impact on EE. Energy losses can consist of technical and commercial losses. Technical losses cannot be avoided completely, and occur due to energy losses through conductors, power lines and equipment used for transformation, transmission, sub-transmission and distribution. Therefore in practice, a limit exists relating to the potential reduction of technical losses. Commercial losses can occur as a result of theft, defective meters, errors in meter reading and in estimating unmetered consumption of energy.

Results of assessment

Data on transmission and distribution losses varies widely between different sources. This could be due to differences in calculation methods and methods of aggregating data sets. Figure 15 illustrates the losses that occur during electric power transmission and distribution using data supplied by the Arab Union of Electricity. As depicted, the variations among countries are large, ranging from 7.7% (Morocco) to 32.5% (Yemen). This is far from the 6% EU average, and considering that most of the losses are commercial, there are ample opportunities for improvement in the transmission and the distribution of power.

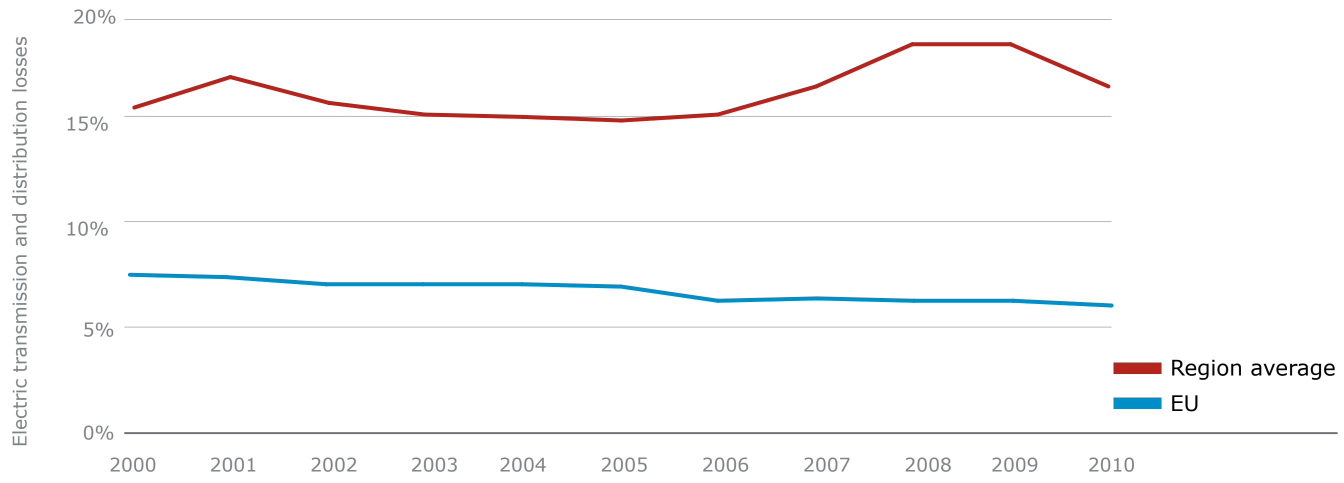
Figure 15: Transmission and distributions losses (2011)



Source: Arab Union of Electricity (2011), Bahrain: World Bank data (2013), EU: European Environment Agency (2013)

Figure 16 shows that, except in 2001, losses were steady during the first part of the past decade and then slightly increased before returning to their original levels at the end of the decade. This highlights the lack of measures that could have reduced the losses and improved efficiency. The opportunity cost of transmission and distribution losses increases as the Arab region's electricity consumption rises annually.

Figure 16: Evolution of power transmission and distribution losses (2000 to 2010)



Source: World Bank (2013)

6.3 Rank under Utility Category

Table 29 presents final scores under the Utility category. The rankings under this category vary significantly from those of previous categories. Countries scored consistently very low under the first indicator – share of RE. As stated earlier, hydro power was excluded in the scoring due to the lack of potential for additional development. Under the power generation efficiency indicator, Tunisia scored the highest and Iraq the lowest. In the transmission and distribution losses indicator, Bahrain scored the highest due to the lowest losses in the region, almost comparable to the average in Europe. Bahrain's small geographical area works to its advantage. The highest losses in the region are observed in Yemen, Iraq, Sudan and Palestine.

Table 29: Final scores under Utility category

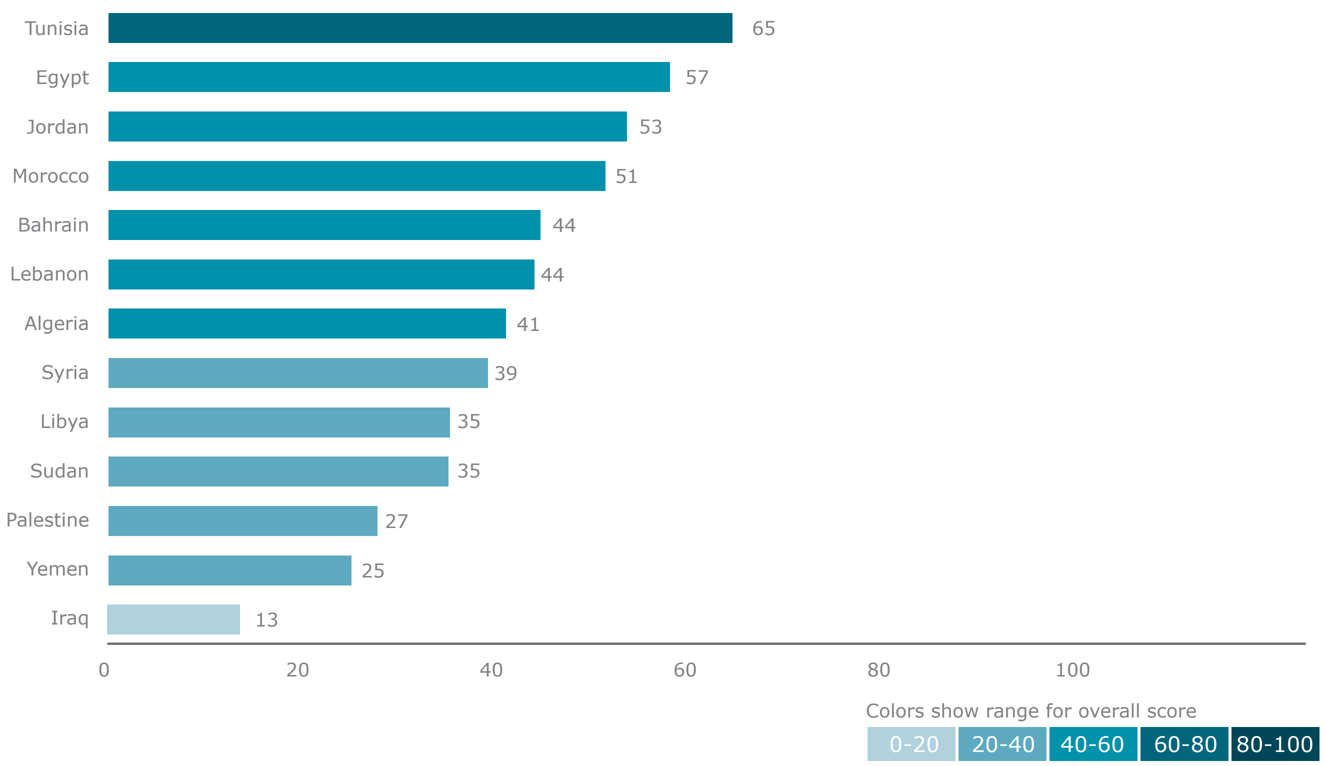
	Share of RE [9]	Power Generation Efficiency	Transmission and Distribution Losses
Algeria	10	74	40
Bahrain	10	23	100
Egypt	12	76	84
Iraq	10	10	19
Jordan	10	75	75
Lebanon	10	38	84
Libya	10	27	69
Morocco	15	74	64
Palestine	11	38	34
Sudan	10	43	52
Syria	10	80	27
Tunisia	14	100	81
Yemen	10	56	10

Figure 17 shows the overall results for the Utility category organized by rank. Tunisia remains the leader in this category, with Egypt second. The results are largely influenced by the dual challenges of efficiently generating and distributing electricity to their end users.

All countries have massive untapped potential for EE in the utility sector. The efficiency in the power generation, transmission and distribution networks remains relatively low compared to the European average. Countries also have substantial unutilized RE resources that could effectively be used to increase energy security and improve environmental performance.

9 Excluding hydro

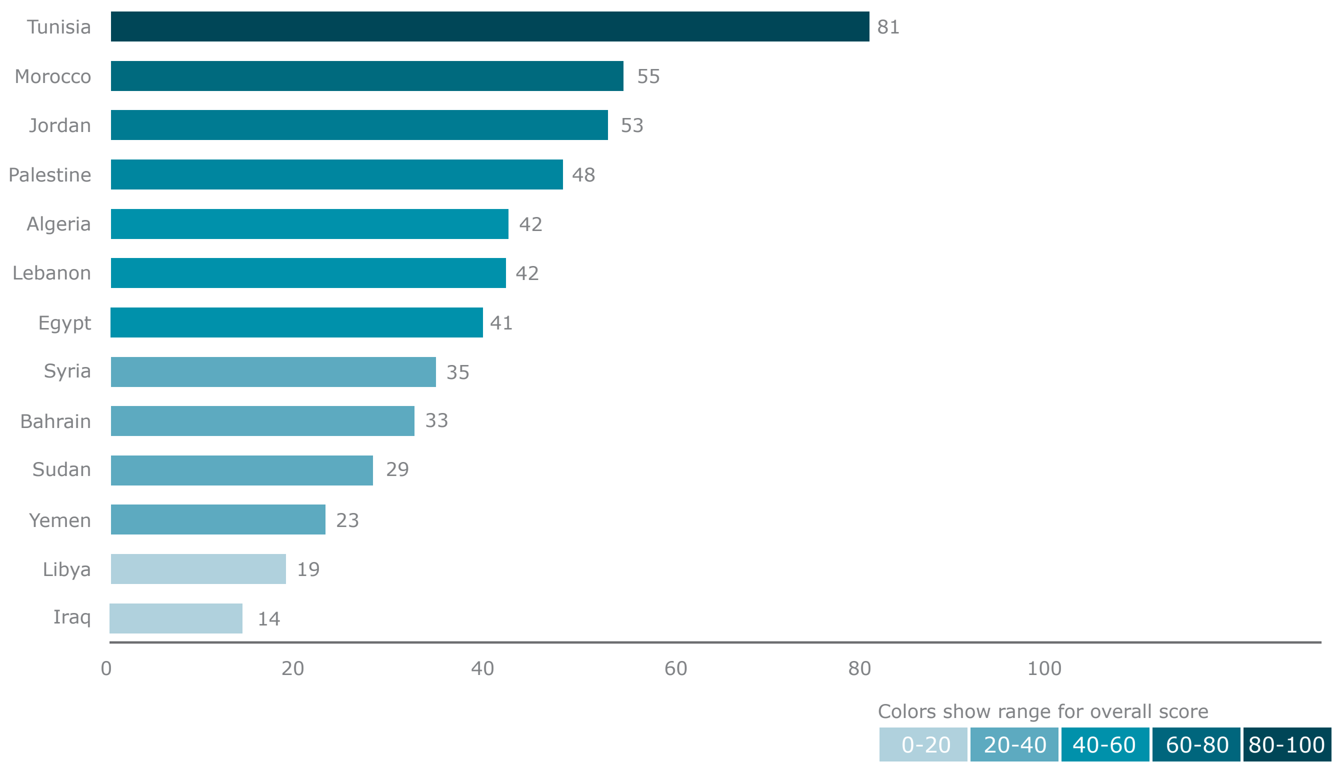
Figure 17: Final scores and ranks under Utility category (excluding hydro)



7. Final Scores and Trend Analysis

Figure 18 presents the final scores and ranks for AFEX Energy Efficiency based on the aggregation of scores under the four evaluation categories.

Figure 18: AFEX Energy Efficiency final scores and ranks



Tunisia 81

In the final ranking, Tunisia emerges as the leader with a score of 81. This is due to Tunisia taking top scores in three of four categories: it currently has the most comprehensive policy framework for EE improvement, the best implementation capacity and the highest efficiency in power generation. The Tunisian policy framework consists of a wide range of measures including regulatory, fiscal and financial instruments, covering electricity and other forms of energy. It impacts all sectors of the economy: residential, tertiary, industrial, utility, lighting, buildings and appliances. Tunisia has demonstrated clear commitment for continuous improvement by periodically monitoring, reviewing, adjusting and tightening EE requirements. The key to its success lies with a strong institutional body consisting of strategic leadership, dedicated resources and competent staff.

Morocco 55 Jordan 53

Morocco and Jordan are almost tied for the second spot, with scores of 55 and 53, respectively. Morocco performs better due to market-based electricity prices and stronger results in the utility sector. These successes allow Morocco to focus on introducing progressive EE policies. Jordan has made substantial progress in the past year in improving its regulatory framework. It should now concentrate efforts on strengthening its implementation capacity in order to properly capitalize on newly introduced EE policies.

Palestine 48

Palestine is next in the index ranking, with 48 points. Palestine, with the highest electricity prices in the region, has the highest rate of SWH diffusion. Conditions in Palestine are conducive to adoption of EE measures, but at the same time challenges exist. Palestine has made a good start by adopting its first NEEAP and by establishing a revolving fund for financing EE projects. It should continue developing its regulatory framework and further explore options to overcome the challenge of financing EE projects.

Algeria 42 Egypt 41

Syria 35 Bahrain 33

The mid-ranking countries – Algeria, Lebanon, Egypt, Syria and Bahrain – have similar EE policy frameworks, but are characterized by heavily subsidized electricity prices. These countries appear to be facing greater challenges in enforcement and compliance, thus the focus should be on smart reform of their energy pricing systems and introducing more cost-reflective tariffs.

Lebanon 42

Lebanon has an active dedicated EE body and has introduced financial schemes that have proven to be functional. However, its current situation includes uncoordinated actions among various stakeholders and a subsidized energy pricing structure. These factors present challenges to more progressive development in EE.

Sudan 29

Sudan is one of the early adopters of a NEEAP, which contains a number of important measures for improvement of EE in the utility sector. It should now concentrate on implementing these measures and building a base for proper monitoring and evaluation.

Yemen 23

Libya 19

Iraq 14

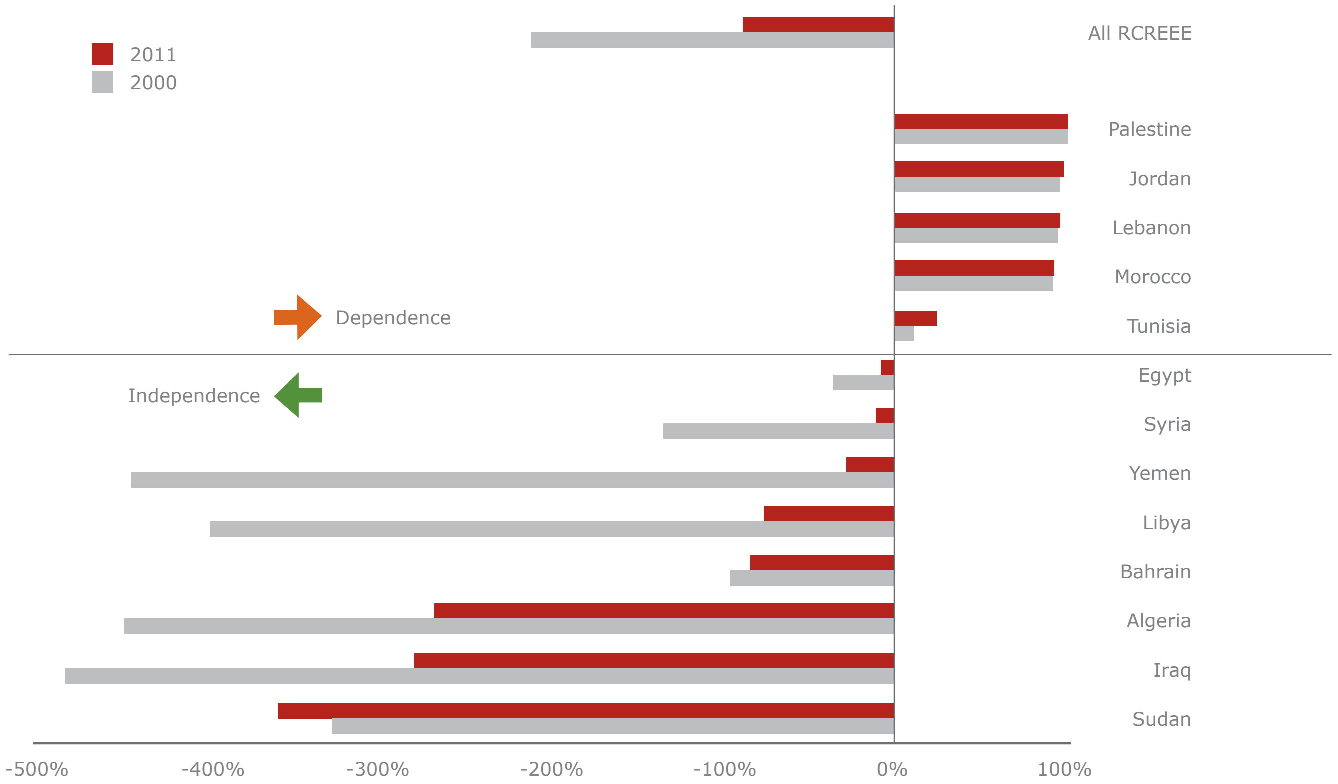
The lagging three countries – Yemen, Libya and Iraq – lack EE policy framework, have weaker institutional capacity, and have higher losses in their power generation, transmission and distribution networks. These countries need to focus on prioritizing, energy planning and mobilizing efforts as they begin to introduce EE measures.

Trends

The index results demonstrate a close relationship with countries' energy dependency ratios illustrated in Figure 19. Taking into account the total energy imports, exports and consumption for each country, a positive ratio indicates dependence and a negative ratio implies the ability to supply energy needs domestically. This relationship is not surprising. It indicates that more energy-dependent countries such as Palestine, Jordan, Morocco, Tunisia and Lebanon have greater motivation to pursue EE. Although Tunisia does not have the highest energy dependence, its situation has weakened in the past 11 years due to population growth and generally increasing energy demand. Notably, the trend for almost all RCREEE members is towards greater energy dependence. EE efforts can play an important role in achieving long-term stability in these countries.

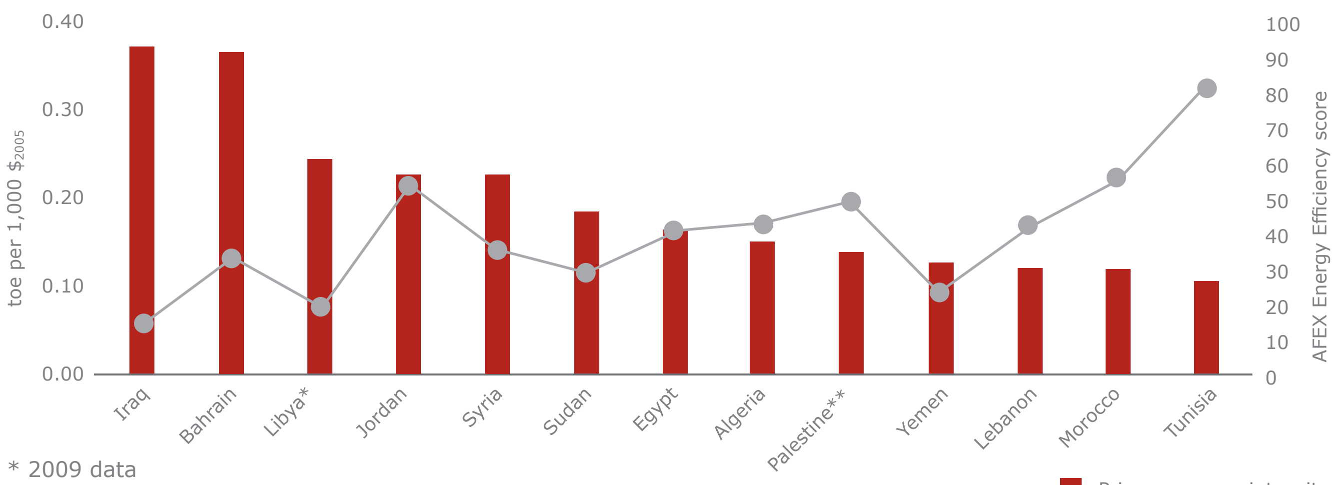
Interestingly, the index results also indicate a trend with primary energy intensity, as illustrated in Figure 20. Countries that score relatively higher in AFEX Energy Efficiency tend to have economies with lower primary energy intensities. Although, it is important to note that energy intensity depends on a number of factors other than EE, such as structure of the economy (service oriented versus industrial), nature of industrial sector (heavy versus light industries), changes in world oil prices and others.

Figure 19: Energy dependency ratio of RCREEE member states (2000 and 2011)



Source: RCREEE estimation based on data from OAPEC (2005, 2012), EIA (2012)

Figure 20: AFEX Energy Efficiency scores and 2010 primary energy intensities



* 2009 data
** Source: EIA
Source: RCREEE estimation based on data from World Bank (2013), EIA (2012)

Overall, EE performance of the region remains low and countries still have massive untapped EE potential. As evidence of this fact, one can take a look at the market of energy service companies (ESCOs), which is currently nearly non-existent. ESCOs are important players in advancing EE, as they possess specialized expertise and knowledge in implementing cost-effective EE solutions. A strong healthy presence of ESCOs in the market gives an indication of the amount of relatively larger-scale EE projects pursued in the country, because ESCOs are driven by the demand for EE services.

Although some countries in the region have undertaken efforts to promote the start and development of ESCOs, in general there is no strong ESCO presence in the market. Research conducted on this subject by RCREEE and PWMSP lists weak capitalization of ESCOs, and lack of financial credibility with the banks as the main challenges to larger market penetration (RCREEE, 2010; PWMSP, 2012). Most ESCOs in the region were established and still exist mostly due to financial support from international donor institutions such as World Bank. Table 30 illustrates the approximate number of ESCOs in the region.

The underdeveloped ESCO presence might be due to several reasons, but in general it indicates a lack of profitability for EE services. Experience seems to indicate a strong correlation between the presence of ESCOs and the current state of EE in a country.

Table 30: ESCOs

Algeria	Bahrain	Egypt	Iraq	Jordan	Lebanon	Libya	Morocco	Palestine	Sudan	Syria	Tunisia	Yemen	Italy
0	0	10	0	5	15	0	0	0	0	1	10	0	1,847

Final Remarks

The index leaders have a natural base for uptake of EE applications due to relatively high electricity prices. In these countries, market-based instruments have strong potential to motivate investments in EE. On the contrary, countries with heavily subsidized energy prices have greater challenges in pushing for EE. Unlike other barriers, energy subsidies constitute an 'active' obstacle to EE, the presence of which will always undermine and impede the effectiveness of efforts to improve EE. When energy prices are low, greater financial incentives are required to stimulate investment in EE projects, more efforts are needed to educate and raise awareness, and to ensure compliance with mandatory EE regulations.

EE is a multi-decade continuous process that requires taking actions on a systematic basis at all levels by a wide spectrum of stakeholders. Assessment under AFEX Energy Efficiency demonstrates that countries with better EE performance are those that have more cost-reflective electricity tariffs, better regulatory frameworks and stronger institutional capacity. To ensure continued attainment of EE goals, careful energy planning is required with targeted measures, robust monitoring and evaluation procedures. 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.

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Annex A. Methodology

The structure of AFEX Energy Efficiency is based on three main components to derive a final index score. It consists of 24 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.[10]

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 13-country group for the indicator;

max is the maximum value observed in the 13-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.

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

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