meetMED

Mitigation Enabling Energy Transition in the MEDiterranean region

Together We Switch to Clean Energy

ASSESSMENT OF APPLIANCES SHARE OF THE TOTAL ENERGY CONSUMPTIONS IN THE SEMCS - SPECIAL FOCUS ON AIR CONDITIONING APPLIANCES

Preparing for Appliances' Regional Program

meetMED is funded by the European Union

This publication was produced with the financial support of the European Union. Its contents are the sole responsibility of MEDENER and RCREEE and do not necessarily reflect the views of the European Union.

Design by REVOLVE

Cover Image: Photo by Gervyn Louis on Unsplash

The meetMED project is a two-year project funded by the EU and jointly carried out by the Mediterranean Association of the National Agencies for Energy Management (MEDENER) and by the Regional Centre for Renewable Energy and Energy Efficiency (RCREEE). Its main goal is to reinforce regional cooperation aimed at fostering the energy transition in Algeria, Egypt, Jordan, Lebanon, Libya, Morocco, Palestine and Tunisia under the umbrella of the UfM REEE platform.

The meetMED team in Brussels coordinates the project partners and experts in implementing the project activities, in the following areas of work: assessing EE and RES strategies and policies; advancing vocational training and public awareness; attracting sustainable RE and EE investments; supporting the UfM Renewable Energy and Energy Efficiency Platform.

The meetMED activities target and benefit a wide range of stakeholders, including policy makers, public authorities, investors and financial institutions as well as local communities and final customers. meetMED supports regional cooperation by building the technical capacity and raising the public awareness necessary to implement RE and EE projects and solutions, while creating synergies with other initiatives targeting energy transition in the Mediterranean region.

MEDENER is an international non-profit organization gathering agencies from the northern and southern Mediterranean countries in charge of implementing public policies on energy efficiency and the promotion of renewable energy sources, by implementing regional projects facilitating the sharing of know-how and best practices among its members and international partners, as well as accelerating the transfer of skills, methods and technologies in the field of energy efficiency and renewable energy.

RCREEE is an intergovernmental organization aiming at enabling the adoption of renewable energy and energy efficiency practices in the Arab region. RCREEE brings together 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. Its key work areas are capacity development and learning, policies and regulations, research and statistics, and technical assistance.

Authors

Authors and Researchers:

Sara ELHAG, RCREEE

Mahmoud BOUOUD, RCREEE

Rana ELGUINDY, RCREEE

Inass ABO KHHODEIR, RCREEE

Akram ALMOHAMADI, RCREEE

Rawad RIZK, RCREEE

Eman ADEL, RCREEE

Data Collection Contributor:

Kholoud BAKRY, RCREEE

Acknowledgements

This meetMED report is part of the meetMED activities on ensuring the positive impact of RE and EE on the sustainable growth, investment facilitation and job creation. The report collects the results of questionnaires, interviews and field research in meetMED target countries to assess the share of total energy consump¬tion connected to the use of household appliances in general and with a special focus on air conditioning. Based on this report, the meetMED experts have prepared a proposal for the design of a regional program for energy efficient household appliances.

The data was collected and elaborated thanks to national experts in Morocco, Algeria, Tunisia, Libya, Egypt, Jordan, Palestine and Lebanon, with special thanks to Rashid Abdallah from the AFREC, Amina Ouattassi from Morocco, Fawzi Benzaid from Alge¬ria, Abdelhamid Khalafallah, Fawzi Alhanshi, Kawther Lihidheb from Tunisia, Ibrahim Yassin, Anhar Hegazi, Mostafa Alsammany, Hany Sharkawy from Egypt, Bassel Yassine from Palestine and Sorina Mortada from Lebanon as well as to the RCREEE team coordinated by Sara Elhag with the support of Mahmoud Bououd, Rana Elguindy, Akram Almohamadi, Inass Abo Khhodeir, Eman Adel and Rawad Rizk and the contribution of Kholoud Bakry.

The authors would also like to acknowledge the contribution of Dr. Maged Mahmoud, meetMED Work Package Leader and Dr. Matteo Barra, meetMED Project Manager..

Acronyms

AC	Air conditioning
AFEX	Arab Future Energy Index
AFREC	African Energy Commission
AMEE	Moroccan Agency for Energy efficiency
ANME	National Agency for Energy Conservation
APOCE	Algerian Organization of Protection and Orientation of the Consumer and his environment
APRUE	National Agency for the Promotion and Rationalization of Energy Use
AUE	Arab Union of Electricity
CAPMAS	Central Agency for Public Mobilization and Statistics
CAS	Central Administration of Statistics
CDER	Renewable Energy Development Center
CEDRO	Country Energy Efficiency and Renewable Energy Demonstration Project for the Recovery of Lebanon
CENDRO	CENDRO United Nations Development Programme
CESCP	Central Egyptian Society for Consumer Protection
CNPC	National Council for Consumer Protection
CPAL	Consumer Protection Association Libya
CREDEG	Centre for Research and Development of the Electricity and Gas
CRTEN	Research and Technology Center of Energy
CSERS	The Center for Solar Energy Research and Studies
CSNER	The National Union Chamber of Renewable Energy
DREG	Small Decentralized Renewable Energy Power Generation
EAG	EL-Araby Group
EDAMA	Energy, Water and Environment Productivity
EDL	Electricity of Lebanon
EE	Energy Efficiency
EE Unit - SG for CoM	Energy Efficiency Unit – Secretary General for Cabinet of Ministers
EEIGGR	Energy Efficiency Improvement and Greenhouse Gas Reduction Project
EgyptERA	Egyptian Electric Utility and Consumer Protection Regulatory Agency
ENSSUP	The Ministry of Higher Education and Scientific Research and the Preparation of Cadres

EOS	Egyptian Organization for Standardization and Quality
EQA	Environmental Quality Authority
GDP	Gross Domestic Product
GEFF	Green Economy Financing Facility
GHG	Greenhouse gases
GIZ	German development agency
GOEIC	General Organization for Export and Import Control
HCP	High Commission Planning
HH	Households
IANOR	Algerian Institute of Standardization
IDECO	Irbid District Electricity Company
IEA	International Energy Agency
IMANOR	Moroccan Institute of standards, Normalization and Certification
IMC	Industrial Modernization Center
INNORPI	Institut National de la Normalisation et de la Propriété Industrielle
INS	National Institute of Statistics
IRESEN	Research Institute in Solar Energy and New Energies
IRI	Industrial Research Institute
ISSET	Supreme Institute of Environmental Science and Technologies
JEA	Jordan Exports Association
JEPCO	Jordan Electric Power Company
JREEEF	Jordan Renewable Energy & Energy Efficiency Fund JREEEF
JSMO	Jordan Standards and Metrology Organization
LAS	League of Arab States
LCEC	Lebanese Center for Energy Conversion
LIBNOR	Lebanese Standards Institution
LNCSM	Libyan National Centre for Standardization and Metrology
LNE	Laboratoire National d'essais
MASEN	Moroccan Agency for Solar Energy
MEDENER	Mediterranean Association of National Agencies for Energy Management
MEM	Ministry of Energy and Mines
MEM	Ministry of Energy, Mines, Water and Environment
MEMR	Ministry of Energy and Mineral Resources
MEMR	Ministry of Energy, Mines and Renewable Energies
MENA	Middle East and North Africa
MEPS	Minimum Energy Performance Standards
MEREL	Ministry of Electricity and Renewable Energy
MEREL	Ministry of Electricity and Renewable Energy of Libya

MEW	Ministry of Energy and Water
MFTI	Ministry of Trade and Industry
MIT	Ministry of Industry and Trade
MoERE	The Ministry of Electricity and Renewable Energy
NEAP	National Energy Efficiency Action Plan
NEEAP	National Energy Efficiency Action Plan
NEPCO	National Electric Power Company
NERC	National Energy Research Center
NRC	National Research Center
NREA	New and Renewable Energy Authority
NSCP	National Society for Consumer Protection
ONEE	National Office for Electricity and Potable Water
ONS	National Statistics Office
PEA	Palestinian Energy Authority
PERC	Palestinian Electricity Regulatory Council
PROMI	Algerian Association for the Promotion of Industry
PSI	Palestine Standards Institution
RAHCCI	Ramallah and Al-Bireh Chamber of Commerce
RCREEE	Regional Center for Renewable Energy and Energy Efficiency
RE	Renewable Energy
REAOL	Renewable Energy Authority of Libya
REERU	Renewable Energy and Environment Research Unit
RISE	Regulatory Indicators for Sustainable Energy
S&L	Standards and Labelling
SEMCs	South Eastern Mediterranean Countries
STEG	Tunisian Company of Electricity and Gas (STEG)
U4E	United for Efficiency
UN	United Nations
UNDP	United Nations Development Program
UTICA	Tunisian Union of Industry, Trade and Handicrafts
WB	World Bank

Table of Contents

Tables and Figures

List of Tables:

List of Figures:

Executive Summary

The population growth rates in the target Southern and Eastern Mediterranean countries (SEMCs) - namely, Algeria, Egypt, Jordan, Lebanon, Libya, Morocco, Palestine and Tunisia - are exponentially increasing, coupled with high economic growth, which increases the demand of energy beyond current supply. This has consequently led to an increase in the emissions of Green House Gases (GHG) in the region and implies the need for adopting climate-friendly solutions satisfying the uprising energy demand, such as energy efficient measures.

Results of statistical research on the electricity consumption in the target countries show that the residential sector has the highest share of electricity consumption amounting to approximately 40% of the total consumption. A closer inspection of the residential consumption shows the share of different appliances' types over the total residential consumption. Although the Air Conditioning (AC) share is not the highest among the household appliances, the analysis shows that it is mostly used during peak hours, thus having significant implications on the electricity bills as well as on the grid balance. Hence, not only the amount of consumption is important, but also the consumption pattern of the appliances during the day as it directly affects the balance of the electrical load.

This meetMED report collects the results of questionnaires, interviews and field research in the target countries assessing the share of total energy consumption connected to the use of household appliances in general, with a special focus on air conditioning. Based on this report, the meetMED experts have prepared a proposal for the design of a regional program for energy efficient household appliances in the target countries.

Based on the analysis of the individual country profiles, Part I of the report provides a regional overview regarding all of the eight target countries under examination on electricity consumption in general, for household appliances, and for air conditioning in particular, on testing laboratories and accreditation bodies, and more in general the regional progress in the deployment

of EE measures. In Part II, the data collected from the desk research and the feedback received from the country questionnaire were used to draft the countries' profiles. For each country, this report elaborates indicators for the electricity supply and demand, for the electricity consumption per sector, for the existing MEPS and labels as well as for the existing policies and regulatory framework on energy efficient household appliances.

With regards to the electricity consumption per sector, the residential sector is the most energy-intensive in the region followed by industrial sector. In fact, the residential sector is the highest electricity consumer in 6 out of the 8 target countries with an average of 43% of the total electricity consumption in the region. The situation is different in Morocco and Tunisia where the industrial sector has always been the major consumer of electricity with average shares of respectively 36% and 29% against 34% and 27% for the residential sector. These two countries record the lowest electricity consumption in the residential sector across the region.

Consistent with the increased use of household appliances, particularly in the modern houses, the electricity consumption by the household appliances is the largest across the residential sector in all target countries. At a regional level, the biggest share of the electricity consumption goes to lighting with an average of 22% of the total electricity consumption by the household appliances, followed by refrigerators, fans and air conditioning with a respective share of 17%, 16% and 10%.

Acknowledged the lack of data related to the electricity consumption by air conditioning in the target countries, an approximation based on experts' assumptions and sparsely collected data was adopted for assessing the share of electricity consumption by air conditioning in the residential sector. The electricity consumption by air conditioning was calculated so as to increase in direct proportion with the yearly growth rate of the residential electricity consumption. The result of estimated calculations indicates that the electricity consumption by air conditioning in all the target countries amounts to an average of 230 kWh per household.

The eight target countries have a well-developed institutional framework for the development of standards and regulations on Minimum Efficiency Performance Standards (MEPS), on the issue of energy efficiency labels and on

the respective procedures. However, only five countries (Algeria, Morocco, Tunisia, Egypt and Jordan) have testing laboratories for at least one appliance. The existing testing labs in Lebanon are limited to safety tests and could be upgraded so as to cover energy efficiency tests. Accreditation body for laboratories exist only in Egypt, Tunisia and Algeria and are accredited by international organizations such as the International Laboratory Accreditation Cooperation (ILAC) and the ANSI National Accreditation Board (ANAB).

In all the examined countries, the national authorities in charge of energy or energy efficiency are in charge of the enforcement of the EE regulations, while facing many technical, financial and regulatory challenges. Part III of this report illustrates the existing MEPS and labels across the SEM region and provides a comparative assessment of the implementation of EE measures across all the target countries, including policies, legal and regulatory frameworks. The existing challenges in the implementation of EE policies and frameworks are further elaborated in relevant policy recommendations.

With regards to the existing MEPS and labels in the SEMCs, 4 out of the 8 target countries (Egypt, Jordan, Algeria and Tunisia) have transformed the technical standards developed by standard institutions in regulations defining the MEPS and labels for appliances.

Only two countries (Egypt and Jordan) have implemented MEPS and labels for more than 3 appliances in addition to lighting. With 10 implemented home appliances (excluding SWH and Lighting), Egypt is the sole country that is adopting an EE regulation for fans due to its wide distribution all over the country.

Morocco is currently developing MEPS and labels thanks to the assistance of international financial institutions, such as EBRD that is supporting AMEE in drafting EE regulations for 3 home appliances. In the same framework, AMEE with EBRD's support is initiating the development of an MVE protocol for appliances.

In Lebanon, the LCEC is currently drafting a new EE law for appliances that is covering a set of three appliances, refrigerators, freezers and ACs. This new regulation consists of three main articles related to enforcing MEPS and labels for both manufactured and imported products, to issuing the appliances list by the Minister of Energy as well as to suggesting to the Ministry of Finance and Costume a list of inefficient appliances to be banned from the market.

It is worth mentioning that the labelling methods and displays of the existing labels in the target countries are not harmonized despite the major technical similarities between the programs. In all the countries considered, the continuous update of the existing MEPS is not aligned with the technological development of the appliances where most of the countries do not have a clear strategy or plans for this process.

The analysis of the national and regional data shows that “Comparative Labelling” is the predominant model for labelling energy efficient household appliances in the region. On the other hand, mandatory MEPS are the most used ones in the region. Records show that Libya is the only country in the region that did not authorize any appliance label so far. No country in the region has adopted any labelling nor MEPS for fans, except for Egypt where MEPS for fans are under development. However, the reason why fans are included in this report -as a stand-alone appliance- is because some studies consider it as part of the cooling/air conditioning systems.

The appliances for which MEPS and labels have been authorized the most in the region are air conditioning, refrigerators and lightings. Overall, MEPS and labels have been authorized in 6 countries. Solar water heaters are subject to MEPS in four countries. MEPS for washing machines have been adopted in two countries and labelling is under development in one country. Although TV sets are subject to MEPS and labels in only 2 countries, they are considered in this report because they are available in almost every household.

Most of the target countries have announced energy targets as well as National Energy Efficiency Action Plans (NEEAP). Moreover, most of the countries established dedicated authorities and implementing agencies for energy efficiency (EE) measures. It is also evident that the implementation of MEPS and labels in the region follow an intermittent rather than a steady progress.

In order to obtain a clear categorization of the countries under consideration, different analysis factors were identified, which cover both the planning and the implementation phases. The constituents of the assessment include announced EE targets, the existence of a dedicated authority, existing MEPS and labels, monitoring and enforcement measures as well as the existence of national industry.

The 8 target countries were assessed for their progress against these factors and their results were documented. Subsequently, the above-mentioned constituents of assessment were used to create a scoring system by which the countries were evaluated on their successful planning and implementation of EE measures. A categorization of the countries based on their obtained scores allowed to list the countries under consideration into 4 groups.

Part IV of the report, concludes that at the national level, it is important to develop policies and regulations that support the deployment of EE measures, such as incentives and reduced taxation on efficient appliances, which will facilitate the acceleration of the adaptation of MEPS and labelling for appliances. The encouragement of technical research is equally important as it explores different technological options for the region that might help deploy EE appliances, such as solar AC. Finally, it is key to recall that stakeholders are essential for the successful implementation of any national program. Hence, spreading awareness is highly important both for the general public and decision makers.

Objective and Methodology

The main objective of this report is to provide a comprehensive study and assessment of the share of residential sector appliances over the total electricity consumption in the Southern Eastern Mediterranean Countries (SEMCs), with a special focus on air conditioning. Another objective of the report is to give a thorough study and analysis on the status of implementation of MEPS and labels in the SEM region. The assessment will help with the preparation of a regional program for appliances.

The adopted methodology follows a top-down approach starting in Part I with a preliminary desk research to give an overview of the energy sector in the SEM region, focusing on the electricity sector and residential/appliances' share of the total consumption.

Based on an extensive desk research and data collection phase, Part II covers with more details the electricity sector and energy efficiency measures in each of the 8 countries subject to this study (i.e. Algeria, Egypt, Jordon, Lebanon, Libya, Morocco, Palestine and Tunisia) and develops country profiles for each country by gathering all relevant data and analysis. In order to get the required data for this part of the study, a stakeholders' identification exercise was carried out with respect to each of the eight countries. Subsequently, a stakeholders' questionnaire was designed that included all required information and data for the study. RCREEE relied strongly on the support of its focal points in all countries to disseminate and fill in the questionnaire. The data collected via the desk research along with the questionnaire feedback was analyzed and categorized to develop the country's profile for individual countries (Part II). Moreover, country missions to 3 countries (i.e. Egypt, Tunisia and Lebanon) were carried out in order to fill the identified data gaps and validate the collected data. During these missions, interviews were conducted in person to ask key stakeholders for an update on the status of MEPS and labels at national and regional levels. All the collected information along with the experts' opinions and insights were used to develop the data analysis and the results presented in Part III.

The final report conclusions, recommendations and proposed future steps are provided in a consolidated report summary in Part IV.

Part I:
Overview of the SEM Region

1.1. Overview

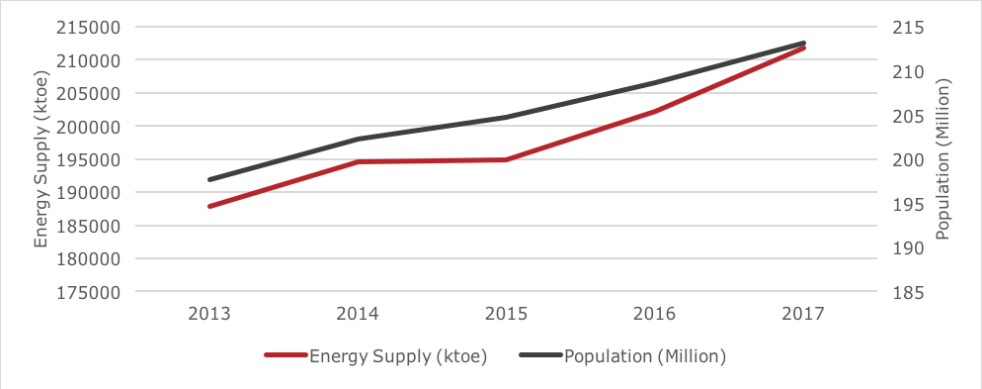
Figure 1 : Map of the SEM region

The Southern Eastern Mediterranean (SEM) region is a linking bridge between Southern Europe and North Africa, it constitutes mainly of 8 countries, namely, Algeria, Egypt, Jordan, Lebanon, Libya, Morocco, Palestine and Tunisia.

The weather in the region is a combination of both an African and Mediterranean climate with generally dry summers and rainy winters, characterized by high temperatures throughout the year and cooler nights.

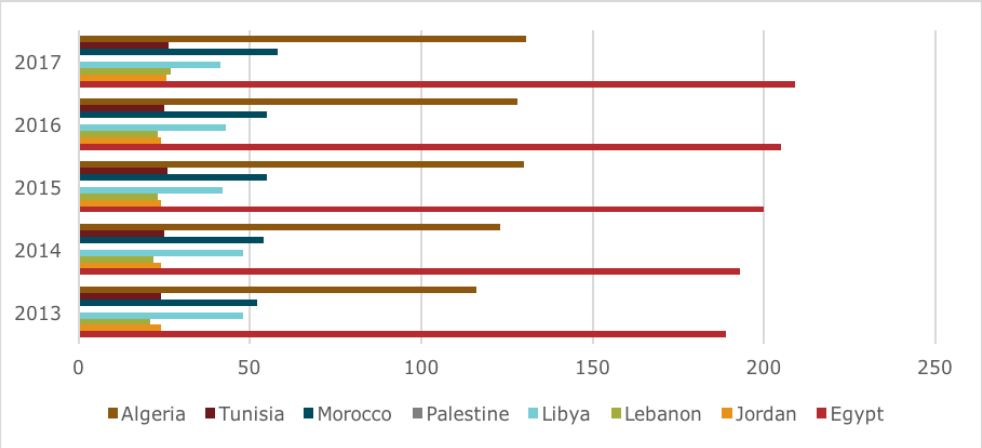
The region is endowed with diversified conventional energy resources as well as natural resources. Most of the countries lie on the solar belt having high average annual solar irradiations.

Figure 2: Energy supply vs. population in SEM region (World Bank, 2012-2017) (IEA, Statistics, 2006-2017)



It is evident that both the energy supply and the population have grown over the years in the SEM region as shown in Figure 2. However, the population growth rate surpassed the increase in the energy supply, which makes the region in constant quest to fulfill the energy needs for the residential sector in the coming years. Therefore, implementing EE measures could be the solution for these countries, considering the rapid depletion of natural resource. Moreover, this is a useful mitigation measure for climate change, especially that the SEM region is considered as one of the highest regions in greenhouse gases (GHG) emissions, as shown in Figure 3. Otherwise, the GHG emissions will lead to significant rise in temperature leading to higher energy demand for cooling purposes.

Figure 3: CO2 emissions (Mt of CO2) in the SEM region



Statistical trends on the electricity consumption distribution on the different economic sectors shows that the residential sector constitutes a considerable share of the total electricity consumption in the SEM region, as shown in Figure 4 and Figure 5 with a total share of 42% in 2016. In 2017, the total share of the residential sector was 40% of the electricity consumption.

Figure 4: Total electricity consumption per sector in SEMCs in 2017

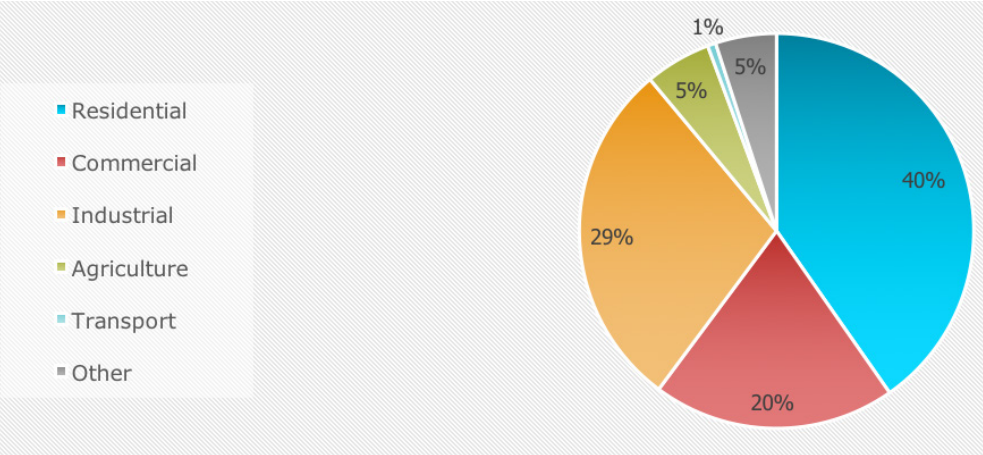
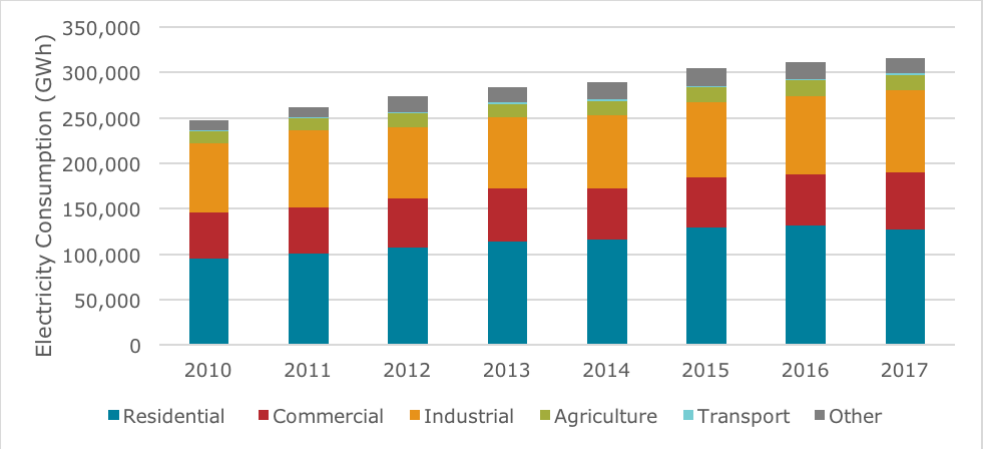
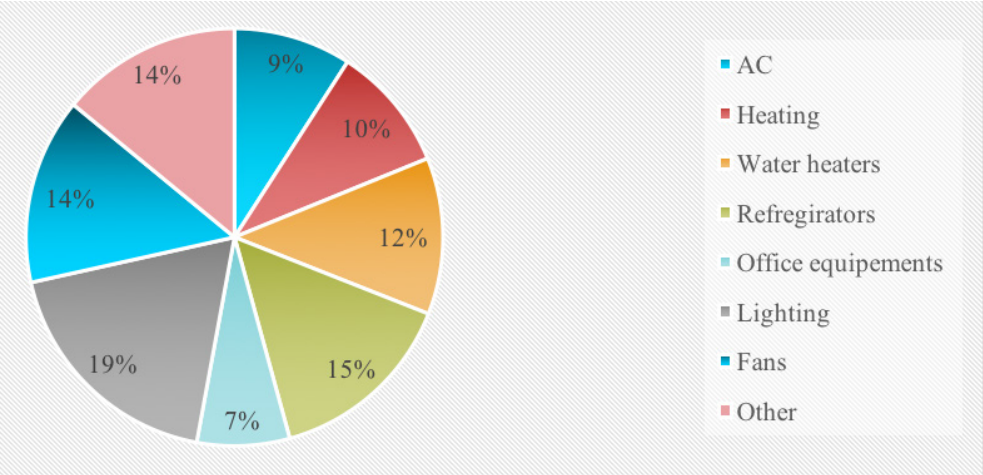


Figure 5: Total electricity consumption per sector in SEMCs in between 2010 and 2017



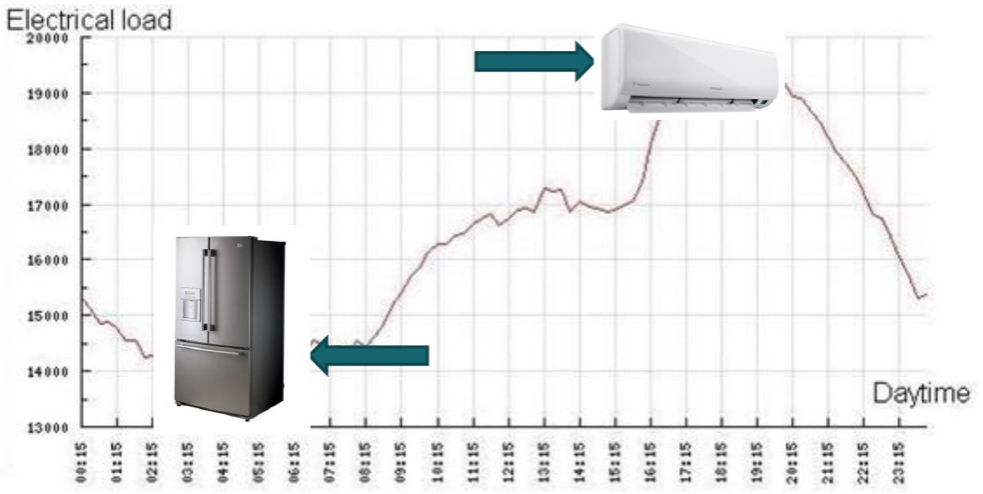
According to (RCREEE, 2012), the appliances share from the residential sector (except for lighting) constitutes 70 to 80% of the total consumption as detailed in Figure 6.

Figure 6: Share of the HH appliances from the residential electricity consumption of the SEMCs (RCREEE, 2012)



Although the AC share is not the highest among the HH appliances, the fact that it is mostly used during peak hours has significant implications on the electricity bills as well as the grid balance. Hence, not only the amount of consumption is important, but also the consumption pattern of the appliances during the day as it directly affects the balance of the electrical load as shown in Figure 7.

Figure 7: Electrical load during the daytime (Atkins, 2012)



Part II:
Detailed Country Profiles

2.1. Detailed Country Profile: Algeria

2.1.1. Country Overview

Algeria is considered as one of the Maghreb countries, which falls under the SEM region. It is considered as one of the middle-advanced countries when it comes to the energy efficiency and renewable energies ranked as the 8th country from the 17 RCREEE member countries according to AFEX. Algeria has progressed a lot since it first introduced the S&L and MEPS in 2009. It is worth noting that Algeria is very advanced when it comes to utility with an overall score of 70%, followed by the institutional capacity scoring 64% (AFEX, 2017).

2.1.2. Country's Analysis

In order to assess any country's economic situation at any time, the first indicator to look at is the gross domestic production (GDP) evolution and its corresponding growth rate. Focusing on Algeria, we can see that its economy has been well progressing at a steady rate until 2014, when it reached almost USD 214 billion and then it started to fall in 2015, reaching only USD 159 billion in 2016. This decrease is mainly due to the international scene and might be a general effect of the economic situation of all the Arab countries (World Bank, 2012-2017). On the other hand, and despite this sudden decrease in the GDP, the population kept rising from 2014 till 2016 with a steady growth rate causing the decrease of the GDP per capita. In 2017, the GDP increased to USD 170.5 billion as well as the population, consequently, caused an increase in the GDP per capita in the year of 2017. Figure 8 and Figure 9 below show in detail the decrease in the GDP per capita, going from USD 5,466 in 2014, reaching only USD 3,915 in 2016 and rising again to USD 4123.9 in 2017. (World Bank, 2012-2017).

Figure 8: GDP and population growth in Algeria (World Bank, 2012-2017)

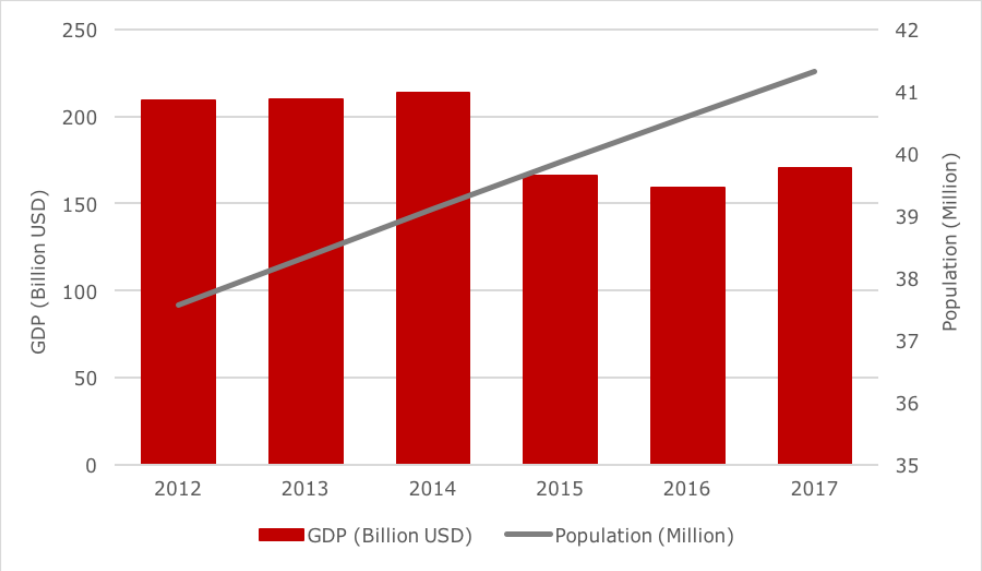
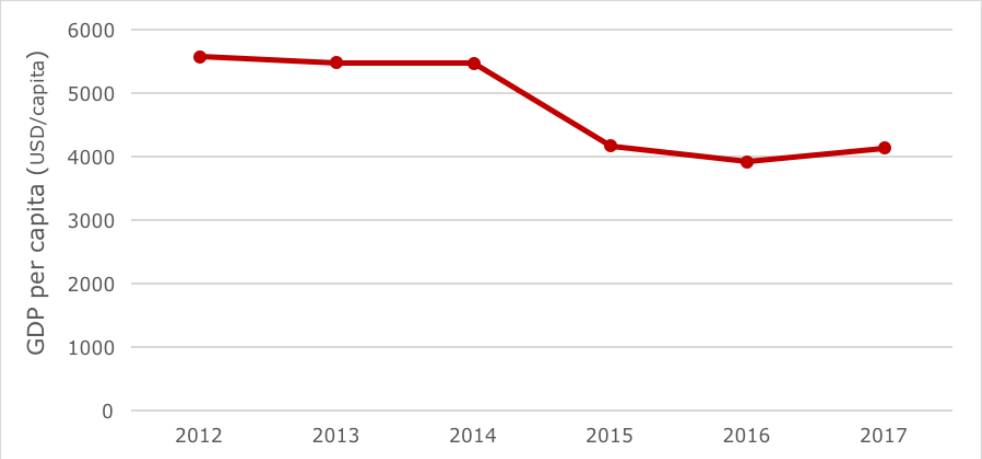
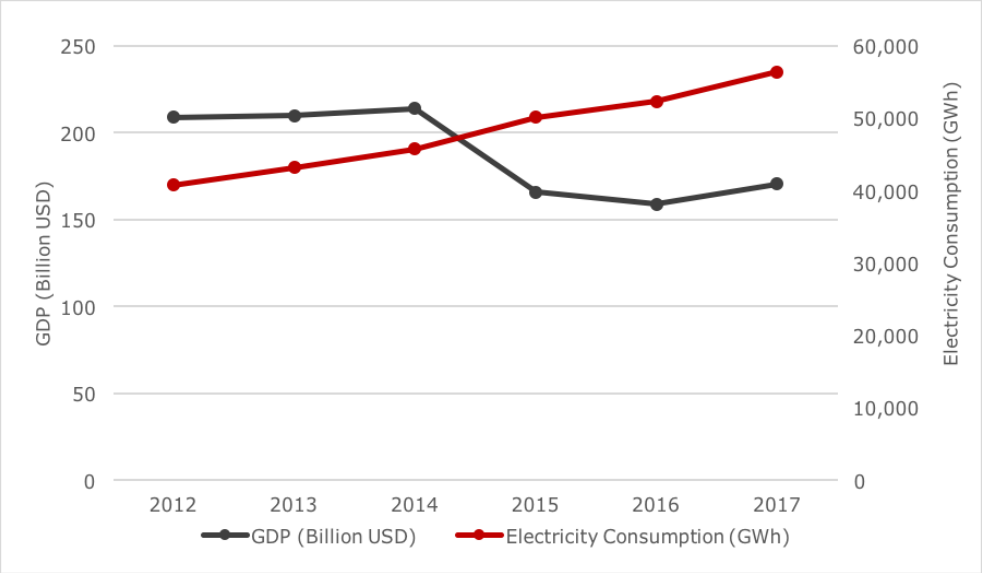


Figure 9: GDP per capita in Algeria from 2012 to 2017



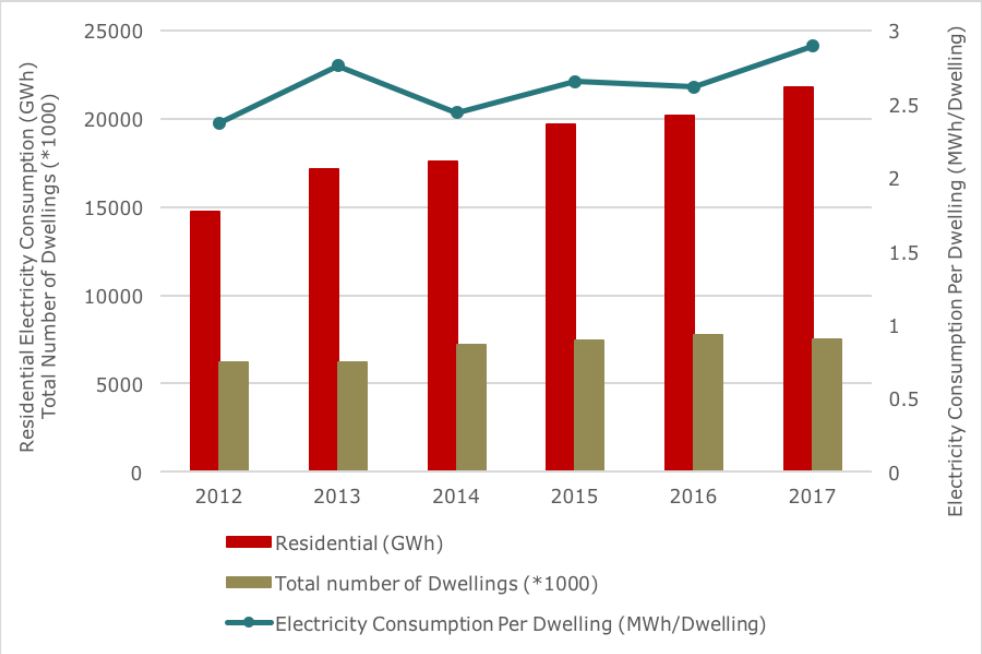
Not only did the population grew steadily, but also, as we can see in figure 10, the electricity use in the country was growing in the past years, moving from around 40,777 GWh in 2012 to reach almost 56,377 GWh in 2017 (IEA, Statistics, 2012-2017). This electricity growth can be directly justified by the increase of population, which surpassed the economic development in the country in the period between 2014 and 2017.

Figure 10: GDP vs. electricity use in Algeria (IEA, Statistics, 2012-2017)



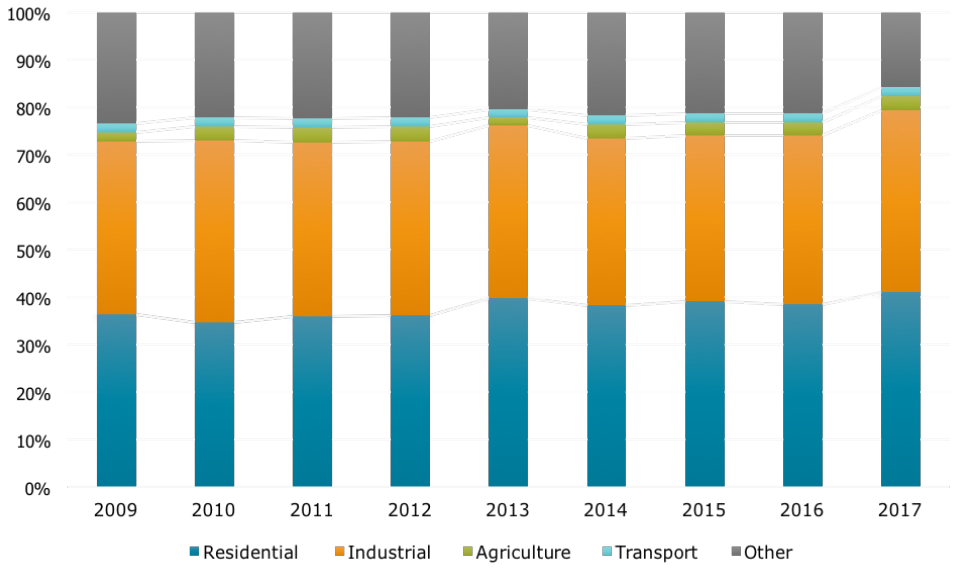
As a natural result of the population increase, the number of dwellings kept increasing in Algeria, and if we look at the electricity consumption in the residential sector in the country, we can see that the share of each dwelling in the electricity consumption moved from 2.37 MWh in 2012 to reach almost 2.9 MWh in 2017 (IEA, Statistics, 2012-2017). This evolution, as illustrated in figure 11, shows that the increase in the number of dwellings in the country even surpassed the increase in the electricity consumption in the residential sector in 2014, causing the overall decrease of the electricity consumption per dwelling in the residential sector. Nevertheless, in 2015, the increase in the number of dwellings was in direct proportion with the electricity consumption, thus causing an overall increase of the electricity consumption per dwelling by 9%. It is worth mentioning that the growth rate from 2012 till 2017 has an overall total of 22% (AUE, Statistical Bulletin, 2012-2017).

Figure 11: Electricity consumption per dwelling in Algeria (AUE, Statistical Bulletin, 2012-2017)



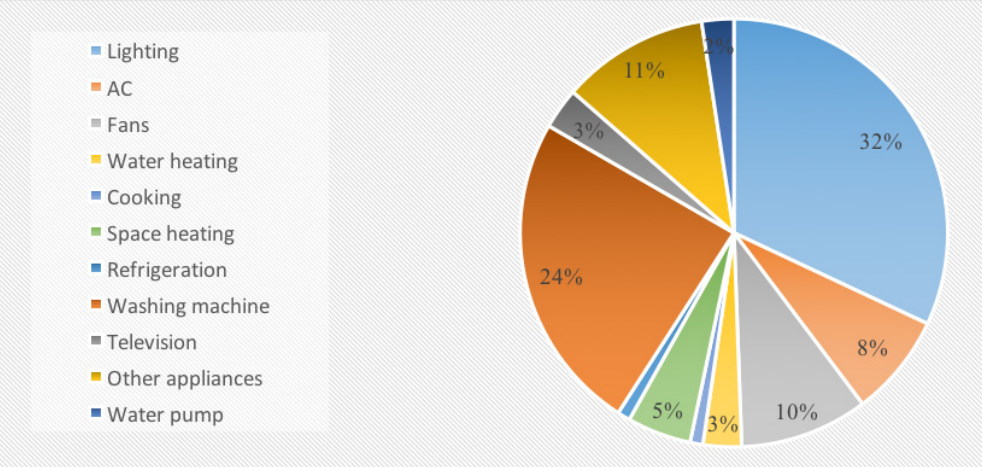
If we focus now on the electricity consumption distribution in the country, we can see that the residential sector has always been the highest consumer in Algeria since 2012. The industrial sector has always followed the residential being one of the most energy intensive sectors in the country. As per figure 12, the residential sector has kept an average of 35% of the total electricity consumption in the country reaching almost 40% of the total consumption of the electricity sector in the year 2017 (IEA, Statistics, 2012-2017).

Figure 12: Electricity consumption share per year in Algeria (IEA, Statistics, 2006-2017)



Moving to the appliances share from the residential sector electricity consumption's, we can say that the appliances constitute almost 80% (RCREEE, 2012) of the total consumption and the biggest share of this consumption goes to lighting with almost 32%. This is directly followed by the washing machines constituting 24%. The AC consumption in 2015 constituted almost 8% of the electricity consumption in the residential sector as per Figure 13 (AFREC, 2018).

Figure 13: Appliances share from the total electricity consumption in the residential sector in Algeria (RCREEE, 2012)

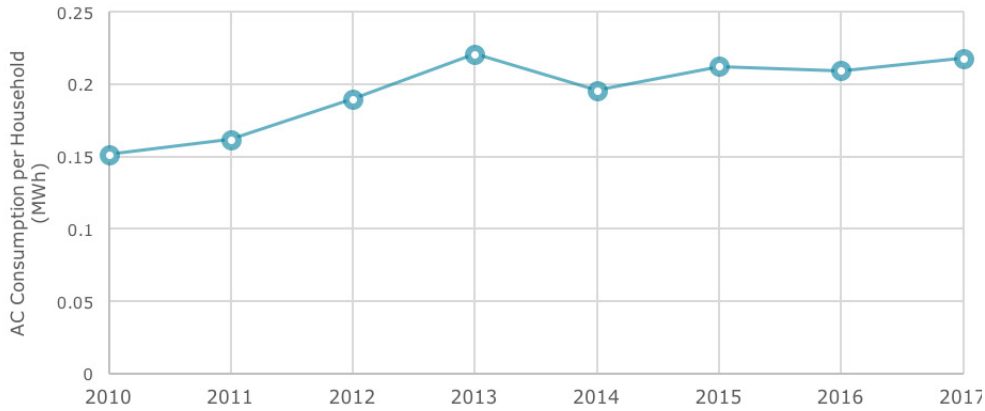


Considering the lack of data related to the AC consumption in the SEM region that the study team have assumed for all the countries, it is now assumed that the AC share from the residential electricity consumption is constant over all the years subject to this report. The AC consumption is calculated to increase in direct proportion with the residential electricity consumption growth rate.

Therefore, focusing on Algeria, the AC consumption have progressed reaching its maximum in 2013 with an average consumption of 0.22 MWh per household. As we can see in Figure 14, the consumption per household decreased slightly in 2014 since the electricity consumption growth rate in this year was only 2.32%. Hence, the increase in the number of dwellings surpassed the increase in the electricity consumption, which resulted in this decrease in the HH AC consumption. Nevertheless, it continued increasing afterwards, reaching 0.217 MWh in 2017 with an overall growth rate of 44% between 2010 and 2017 (AFREC, 2018) (IEA, Statistics, 2006-2017).

It is also worth noting that the AC sales in 2013 constituted 49.2% of the Maghreb region's (Morocco, Tunisia, Algeria and Libya) sales with a total of 1,404,000 units. These units are mainly of class D (41.7%) as per the Algerian standard, followed by 35.2% of class B sales whilst class A only constituted 7.4% of the total sales (WBG, 2016).

Figure 14: AC consumption per household in Algeria (RCREEE calculations)



2.1.3 Relevant Insights for Assessing the Appliances

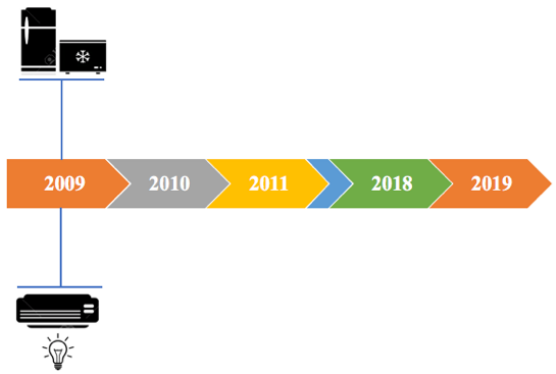
As for the appliances in the country, we have identified the list of appliances with MEPS and labels, along with their type and current status as can be seen in Table 1 below.

Table 1: MEPS / Labels and standards and their status in Algeria

	MEPS		S&L		
Appliances	Current Status	Regulation Type	Current Status	Regulation Type	Policy Type
Light bulbs	In place	Mandatory	In place	Mandatory	Comparative
Refrigerators	In place	Mandatory	In place	Mandatory	Comparative
Freezers	In place	Mandatory	In place	Mandatory	Comparative
AC Units	In place	Mandatory	In place	Mandatory	Comparative
Electric Water heater	-	-	-	-	-
Solar Water Heaters	-	-	-	-	-
Electric ovens for food	-	-	-	-	-
TV	-	-	-	-	-
Washing machines	-	-	-	-	-
Fans	-	-	-	-	-
Dishwashing machine	-	-	-	-	-

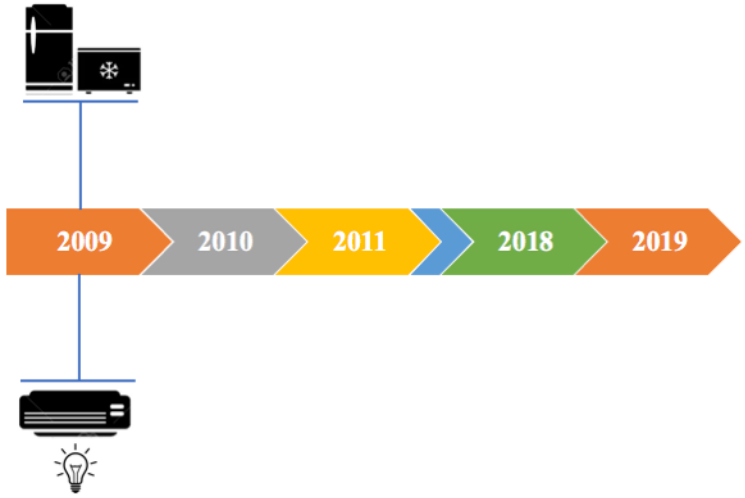
The appliances labels and standards as well as the Minimum Energy Performance Standards (MEPS) in Algeria have been well established since 2009, having several laws and by-laws mainly Lighting, Refrigerators and freezers in addition to AC aiming at increasing the appliances' efficiency in the country.

Figure 15: MEPS timeline in Algeria

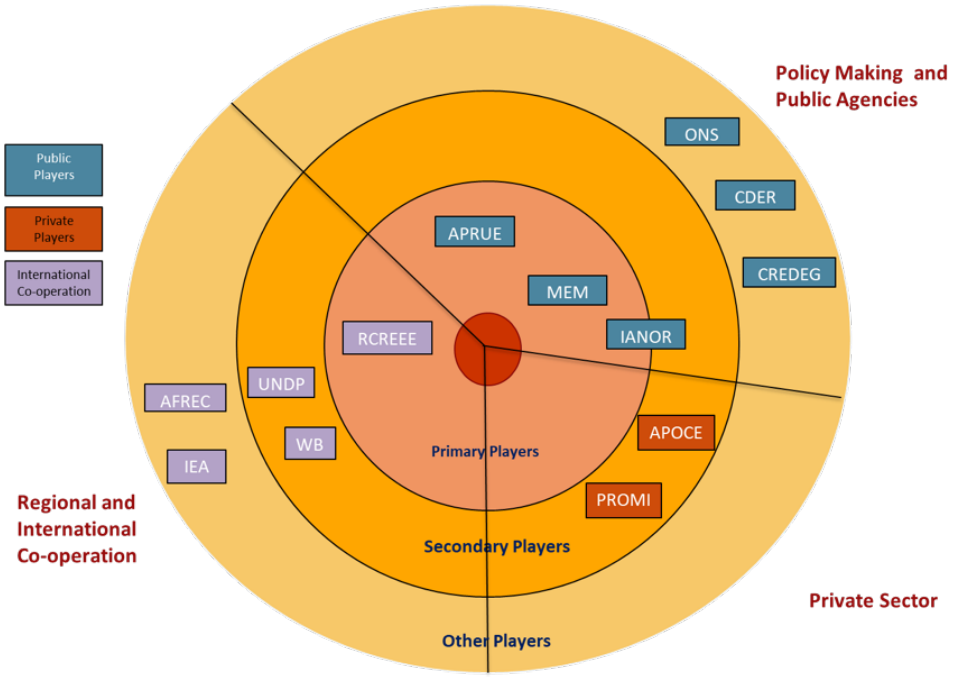


In Algeria, cotecna inspection is the authorized body to issue quality control certificates for imports. The national testing laboratory in the country is the *Laboratoire National de Métrologie et d'Essais* (LNE). As for the inspection, verification, testing and certification, it is all handled by SGS Algeria.

Figure 16: Standards and Labels timeline in Algeria



2.1.4. Key Stakeholders for Policy Design and Implementation



The chart above illustrates the key players and stakeholders in Algeria. It is mainly divided into three layers, the primary players that mainly include the public players as the Ministry of Energy and Mine, APRUE and the Algerian Institute of Standardization. This is followed by the secondary players, which also contains part of the public, private and international co-operation, such as the Algerian Organization of Protection and Orientation of the Consumer and his environment (APOCE) and the World Bank and finally other players, such as the IEA and the AFREC.

2.2. Detailed Country Profile: Egypt

2.2.1. Country Overview

Egypt, long known for its ancient civilization, is considered as the largest Arab country. It is considered as one of the very advanced countries in the MENA region when it comes to the Energy Efficiency and Renewable Energies. According to the AFEX, Egypt has ranked as the 6th with an overall of 57% when it comes to Energy Efficiency. The country had the highest score in the utility section followed by the institutional capacity and the political framework. When it comes to appliances, we can say that Egypt has a very well-established MEPS, labels and standards since 2003 and is considered as one of the first movers in this domain (AFEX, 2017).

2.2.2. Country's Analysis

Egypt has faced a lot of political instability since 2011, and accordingly the country's economic situation has faced a lot of fluctuations since then. In figure 17, we can see that the GDP has been progressing at a steady rate since 2012 starting from USD 279.4 billion and reaching USD 305.5 billion in 2014 (World Bank, 2012-2017). In 2015, the country experienced a higher increase in its GDP, which reached USD 332.7 billion reflecting the increase in the economic stability in this year followed by a small decrease in 2016 then a sharp decrease in 2017 mainly because of the Egyptian pound devaluation. On the other hand, the Egyptian population continued growing from 2012 till 2017 with an overall growth rate of 11% reaching almost 97.55 million in 2017. Hence, and as can be seen in figure 18, the GDP per capita grew steadily from 2012 till 2015, with a slight decrease in 2016 to reach almost USD 3534,

followed by the sharp decrease in 2017 due to the decrease in the GDP along with the increase of the population. (World Bank, 2012-2017).

Figure 17: GDP and population growth in Egypt (World Bank, 2012-2017)

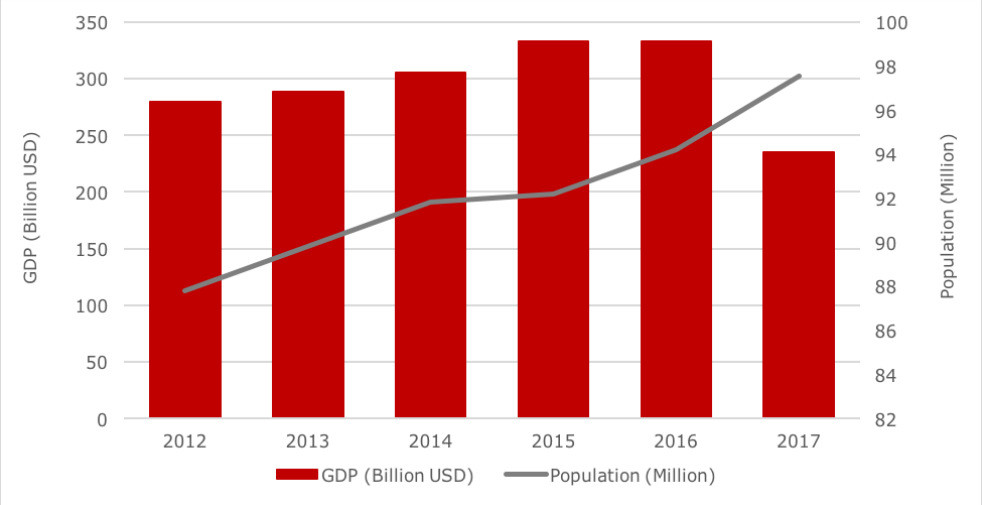
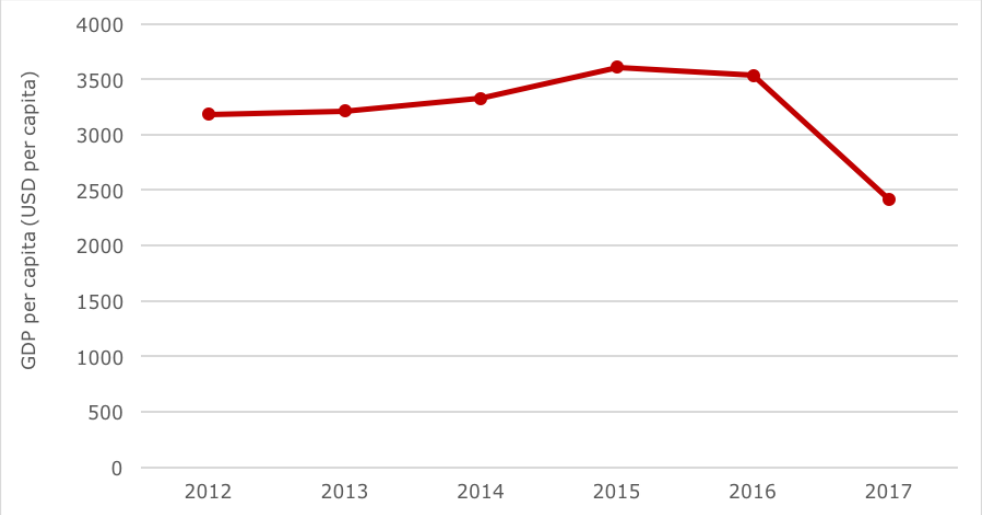
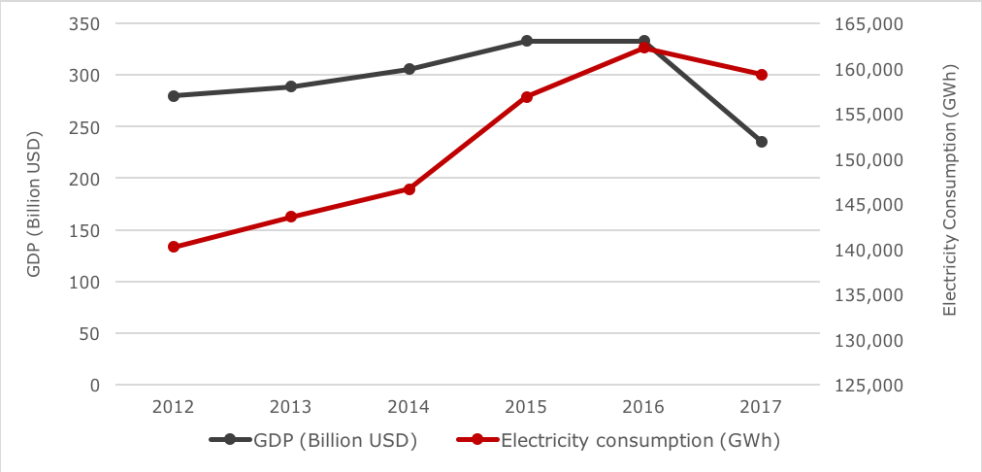


Figure 18: GDP per capita (USD) in Egypt from 2012 to 2017



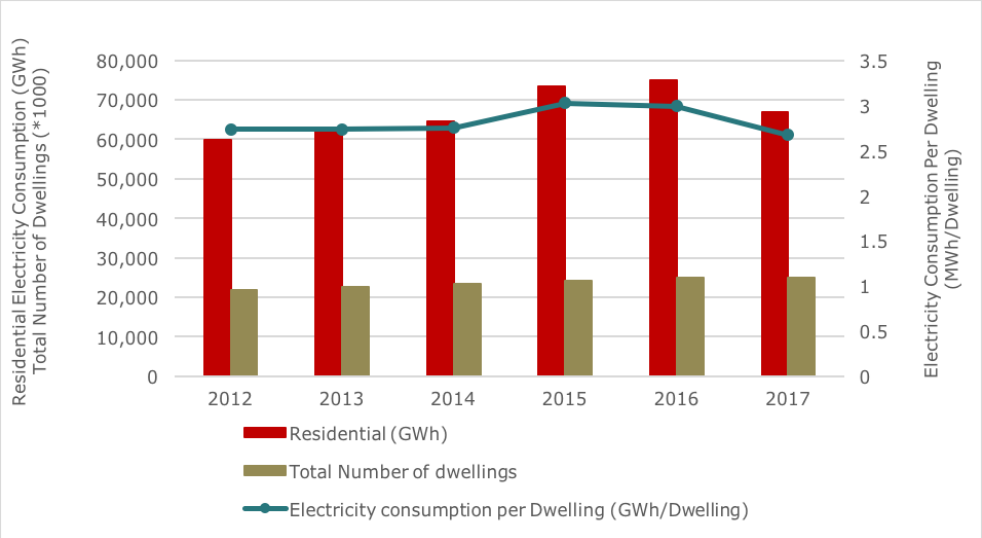
Not only did the population and the GDP grew steadily, but also as we can see in figure 19, the electricity use in the country was growing in the past years, moving from around 140,257 GWh in 2012 to reach almost 162,275 GWh in 2016 (IEA, 2012-2017). This electricity growth can be directly justified by the increase of population as well as the number of dwellings in Egypt in the period between 2014 and 2016. The electricity use showed a decrease in 2017 to 159,339 GWh.

Figure 19: GDP vs. electricity use in Egypt (IEA, 2012-2017)



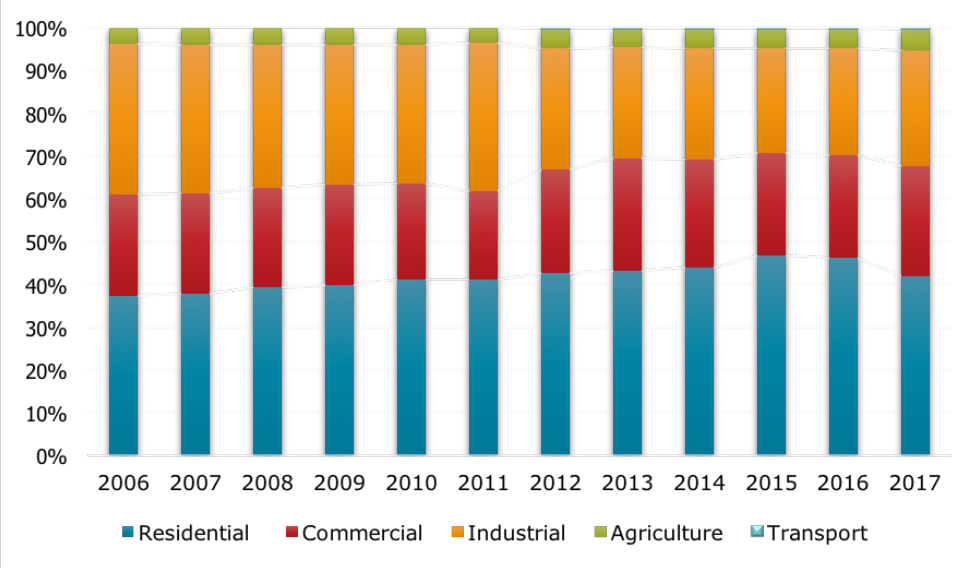
As a natural result of the population increase, the number of dwellings kept increasing in Egypt, and if we look at the electricity consumption in the residential sector in the country, we can see that the share of each dwelling in the electricity consumption moved from 2.73 MWh in 2012 to reach almost 2.99 MWh in 2016, then dropped to 2.67 MWh in 2017 (IEA, Statistics, 2012-2017). This evolution, as illustrated in figure 20, shows that the increase in the number of dwellings in the country even surpassed the increase in the electricity consumption in the residential sector in 2016 causing the overall decrease of the electricity consumption per dwelling in the residential sector (Euromonitor, 2018), which had an overall growth rate of – 1.20% in this specific year. It is worth mentioning that the growth rate of the electricity consumption per dwelling from 2012 till 2016 has an overall total of 9.41%. In 2017, although there was a slight increase in the number of dwellings, the electricity consumption per dwelling showed a decrease in accordance with the decrease in the residential sector electricity consumption.

Figure 20: Electricity consumption per dwelling in Egypt (AUE, 2012-2017)



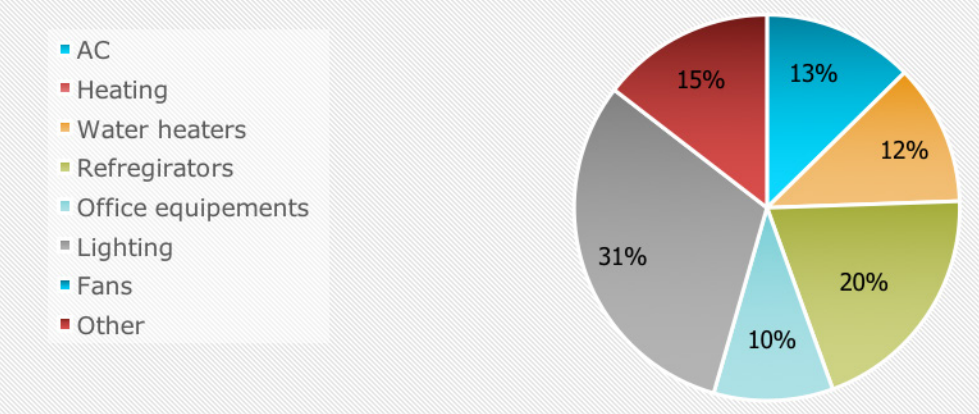
If we focus now on the electricity consumption distribution in the country, we can see that the residential sector has always been the first consumer in Egypt since 2012 (AUE, Statistical Bulletin, 2012-2017). The industrial sector has always followed the residential being one of the most energy intensive sectors in the country. As per figure 21, the residential sector has kept an average of 42% of the total electricity consumption in the country reaching almost 46% of the total consumption of the electricity sector in the year 2016 with a consumption of 74,856 GWh, followed by the industrial sector with a share of 25%. The residential consumption decreased in 2017 to 66,807 GWh, still it has the highest share of the electricity used, followed by the industrial. (AUE, Statistical Bulletin, 2012-2017).

Figure 21: Electricity consumption share per year in Egypt (AUE, 2006-2017)



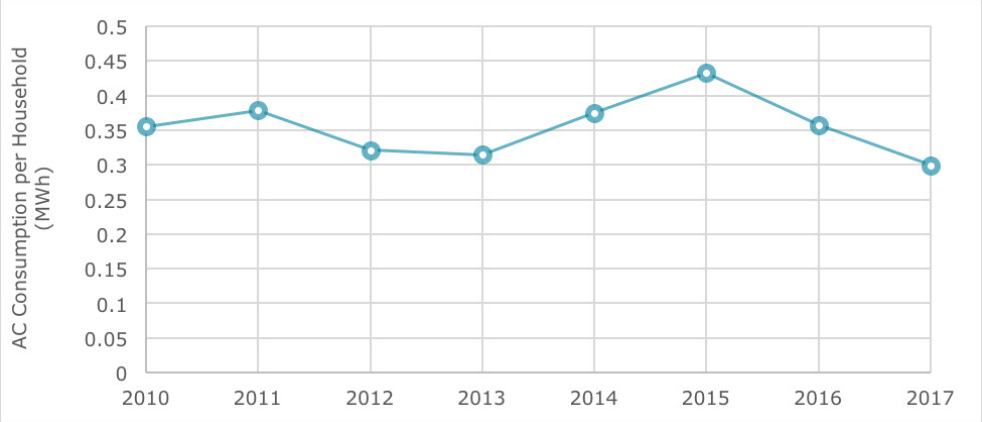
Moving to the appliances share from the residential sector electricity consumption's, we can say that the appliances constitute almost 80% of the total consumption and the biggest share of this consumption goes to lighting with almost 31%. This is directly followed by the refrigerators constituting 24% of the total consumption. The AC consumption in 2010 according to the RCREEE study constituted almost 13% of the electricity consumption in the residential sector as per Figure 22 (RCREEE, 2012).

Figure 22: Appliances share from the total electricity consumption in the residential sector in Egypt (RCREEE, 2012)



Over the years, the AC consumption in Egypt have progressed reaching its maximum in 2015 with an average consumption of 0.43 MWh per household. As we can see in Figure 23, the consumption per household decreased slightly in 2016 and 2017 since the electricity consumption in residential sector decreased by around 10% between 2015 and 2017. Given the assumption that the AC consumption is the same over the years, we can say here that the increase in the number of dwellings, which reached 24%, surpassed the increase in the electricity consumption which resulted in this decrease in the AC consumption per household reaching around 0.3 MWh in 2017.

Figure 23: AC consumption per household in Egypt (RCREEE estimation)



2.2.3. Relevant Insights for Assessing the Appliances

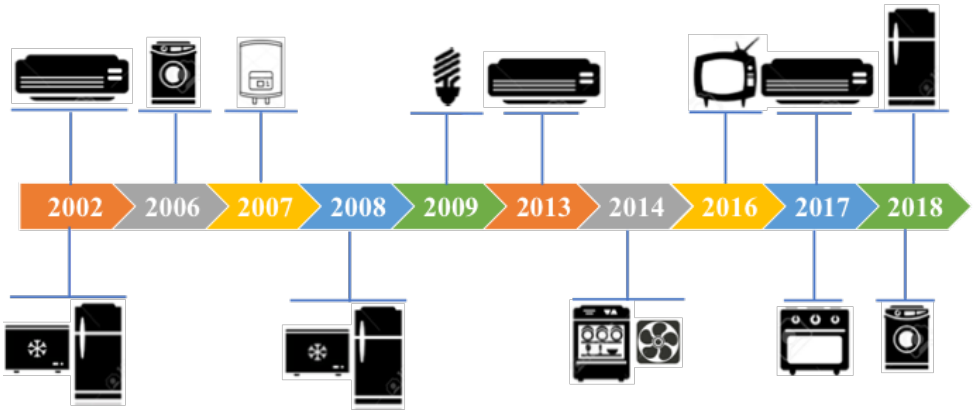
As for the appliances in the country, we have identified the list of appliances with MEPS and labels, along with their type, and current status as can be seen in Table 2 below (RCREEE consultations).

Table 2: MEPS / Labels and standards and their status in Egypt (CLASP, 2018) (AFEX, 2017)

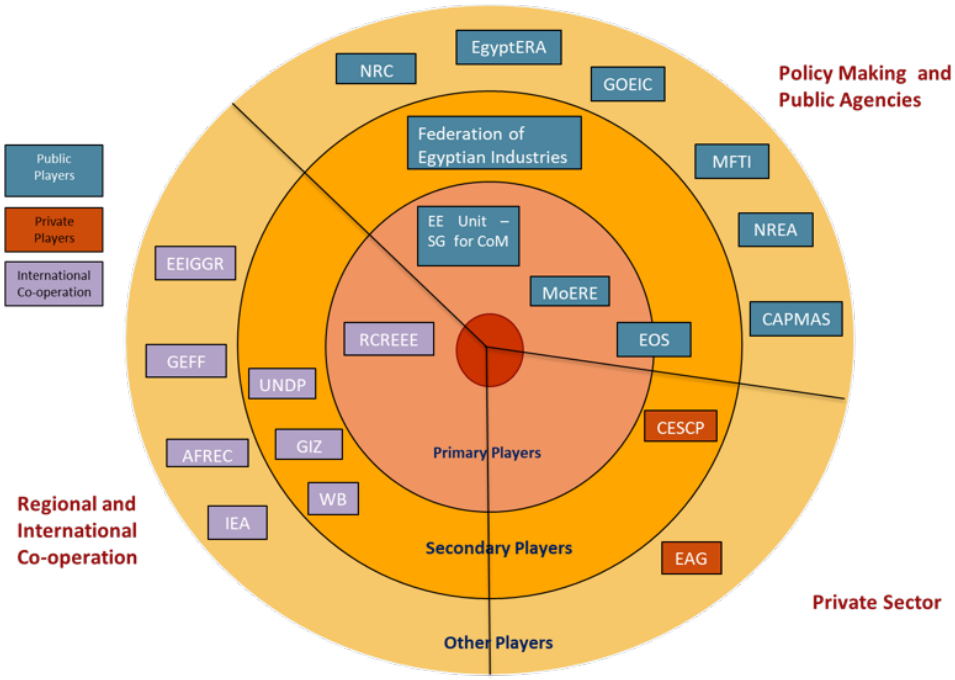
	MEPS		S&L		
Appliances	Current Status	Regulation Type	Current Status	Regulation Type	Policy Type
Light bulbs	In place	Mandatory	In place	Mandatory	Comparative
Refrigerators	In place	Mandatory	In place	Mandatory	Comparative
Freezers	In place	Mandatory	In place	Mandatory	Comparative
AC Units	In place	Mandatory	In place	Mandatory	Comparative
Electric Water heater	-	-	In place	Voluntary	Comparative
Solar Water Heaters	In place	Mandatory	In place	Mandatory	Comparative
Electric ovens for food	In place	Mandatory	In place	Mandatory	Comparative
TV	In place	Mandatory	In place	Mandatory	Comparative
Washing machines	In place	Mandatory	In place	Mandatory	Comparative
Fans	In place	Mandatory	In place	Mandatory	Comparative
Dishwashing machine	In place	Mandatory	In place	Mandatory	Comparative

The appliances labels and standards as well as the Minimum Energy Performance Standards (MEPS) in Egypt have been well established since 2002 as illustrated in Figure 24, having several laws and by-laws mainly directed to increase the appliances' efficiency in the country (RCREEE consultations).

Figure 24: MEPS and Labels timeline in Egypt (RCREEE consultations)



2.2.4. Key Stakeholders for Policy Design and Implementation

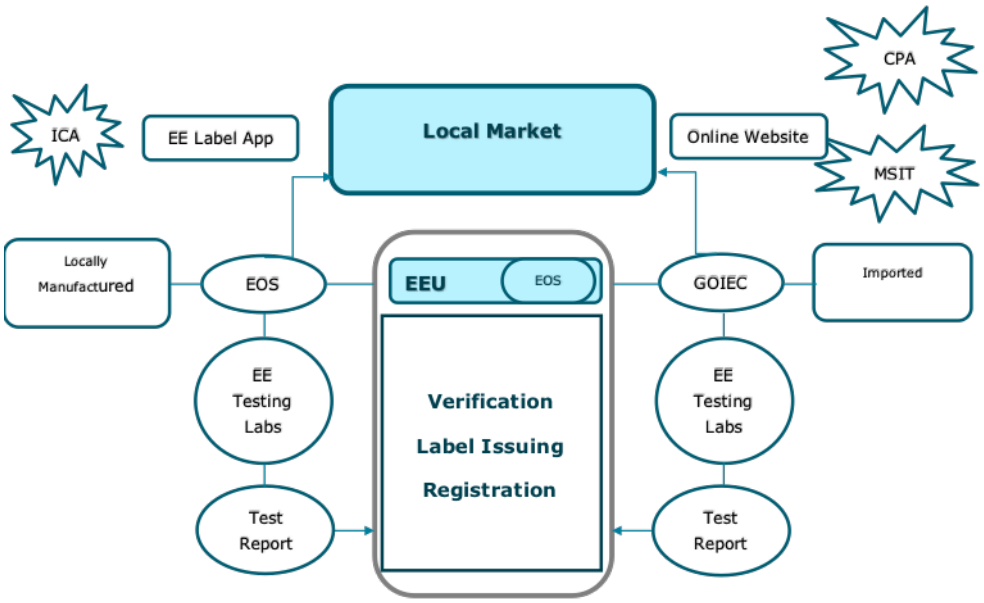


As previously described in Algeria, the key players and stakeholders chart contains three layers of players: in the primary set we can find in Egypt the Ministry of Electricity and Renewable Energy and the Energy Efficiency Unit – Secretary General for Cabinet of Ministers; this is followed by the secondary players such as the Central Egyptian Society for Consumer Protection and the UNDP; finally, this is followed by the other players, which might be common in all the SEM region, such as the IEA and AFREC.

In Egypt, the Egyptian Organization for Standardization and Quality control (EOS) is the one responsible for issuing the labels and setting the regulations in collaboration with the other stakeholders. Additionally, in the absence of an energy efficiency agency in the country, the Improving Energy Efficiency for Lighting and Appliances Project played a crucial role in initiating all the programs and ensuring a solid collaboration between different stakeholders. Moreover, the Egyptian Accreditation Council (EGAC) is responsible for accrediting the laboratories and certification of the testing organization. As for the testing, in addition to the EOS, the General Organization for Export and Import Control (GOEIC) along with the National Renewable Energy Authority

(NREA) have accredited laboratories for testing the compliance of appliances. Finally, the National Institute for Standards (NIS) is responsible for the calibration of measuring instruments. Figure 25 illustrates the adopted implementation process of MEPS and Labeling program in Egypt.

Figure 25: Implementation process of MEPS and Labeling program in Egypt



2.3. Detailed Country Profile: Jordan

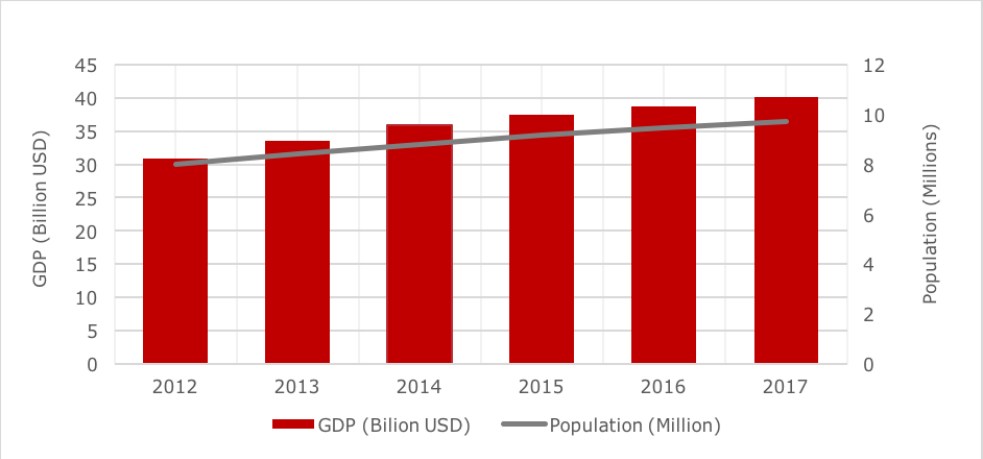
2.3.1. Country Overview

Jordan is one of countries that depends on imported fuel to meet its energy demand, which is considered as the main challenge that faces the country in securing the energy supply. It is worth noting that in the period between 1982-2011 the demand for primary energy increased from 2.4 million Toe to 7.5 million Toe. Given that the residential sector accounts for the largest share of electricity consumption, which represents 43%, reducing the energy consumption in this sector will have significant economic impacts, in addition to environmental benefits by reducing the harmful emissions (Khaled Bataineh & Ayham Alrabee, 2018) (IEA, Statistics, 2018).

2.3.2. Country's Analysis

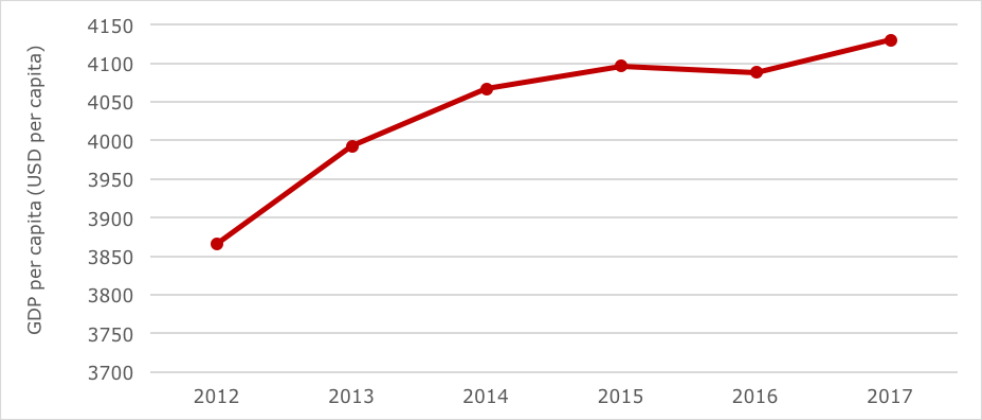
The GDP is considered one of the important indicators to measure the economic growth of any nation. In Jordan, the GDP showed steady growth over the last six years as it amounted to USD 40.07 billion in 2017 compared to USD 30.94 billion in 2012 and the growth rate between 2012 and 2017 was 29.67%. On the other hand, the population also witnessed an increase within the above-mentioned period with gradually increasing growth rate as it reached to around 9.702 million in 2017. Figure 26 below shows the relation between the GDP and the population during the last six years.

Figure 26: GDP vs Population in Jordan, Source: World Bank (2012-2017)



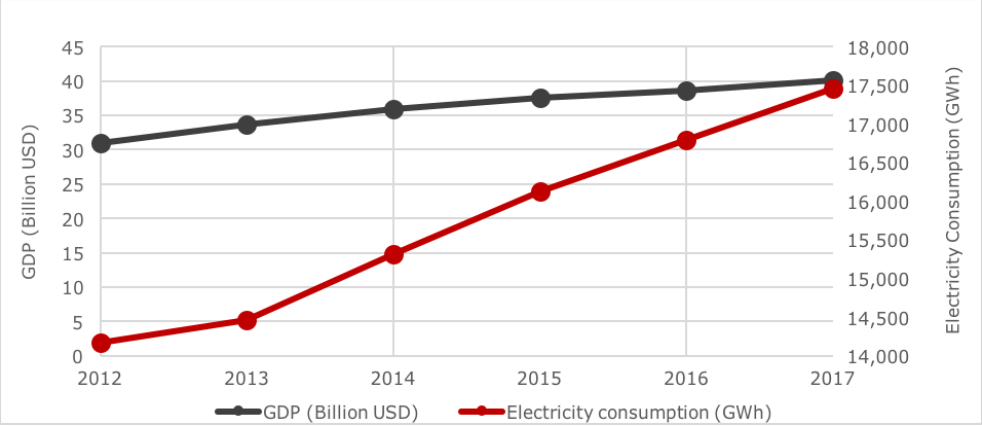
On the other hand, the GDP per capita in Jordan in the period 2010-2015 showed gradual growth rate. It increased from USD 3866.3 in 2012 to USD 4,096.5 in 2015. However, in 2016, the GDP per capita fell to USD 4087. In 2017, as the increase in GDP surpassed the population growth, the GDP per capita showed a consequent increase (World Bank, 2012-2017), shown in figure 27.

Figure 27: GDP per capita in Jordan from 2012 to 2017



The total electricity consumption in Jordan increased dramatically, especially from 2013 to 2017. Furthermore, during the past six years the average consumption growth rate represented around 23.2%. One of the important reasons behind this growth can be attributed to the population growth seeing that the households consume the largest share of the electricity generated in the country. Figure 28 below represents the growth of GDP and the electricity consumption during the last six years.

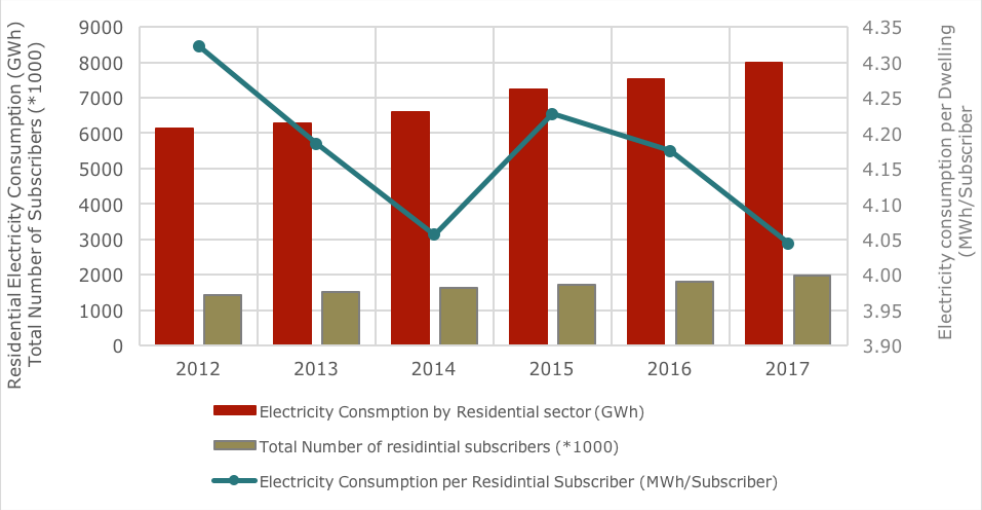
Figure 28: GDP vs Electricity Consumption, Source: (World Bank, 2012-2017) (IEA, Statistics, 2012-2017)



Now focusing on the number of subscribers (Figure 29) we can see that this kept increasing over the past years and the total number of the residential subscribers moved from 1,417,000 in 2012 to 1,978,000 subscribers in 2017.

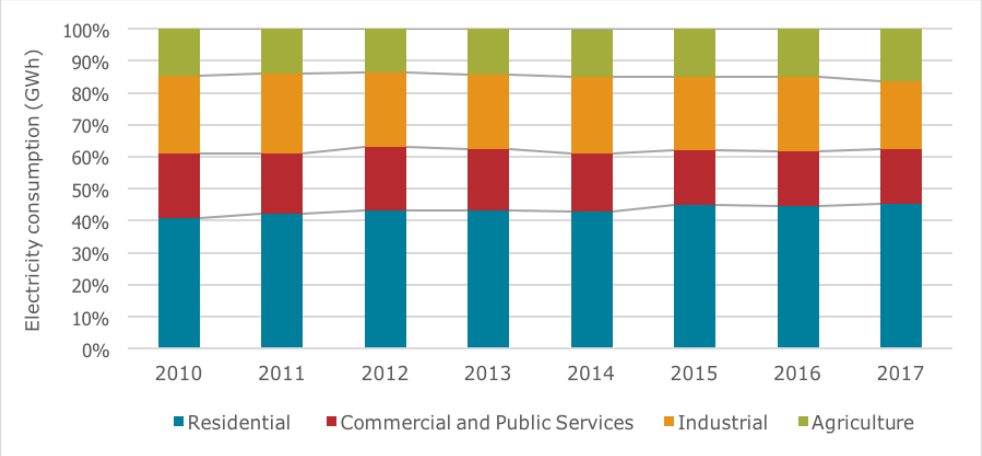
Similarly, the electricity consumption in the residential sector was also increasing, in 2017 reached 7,999 GWh. Meanwhile, the average electricity consumption per household from 2012 to 2017 was slightly fluctuating with an overall average of 4.17 GWh.

Figure 29: Residential consumption, number of residential subscribers and the consumption per residential subscriber, Source (AUE, Statistical Bulletin, 2012-2017) (IEA, Statistics, 2012-2017)



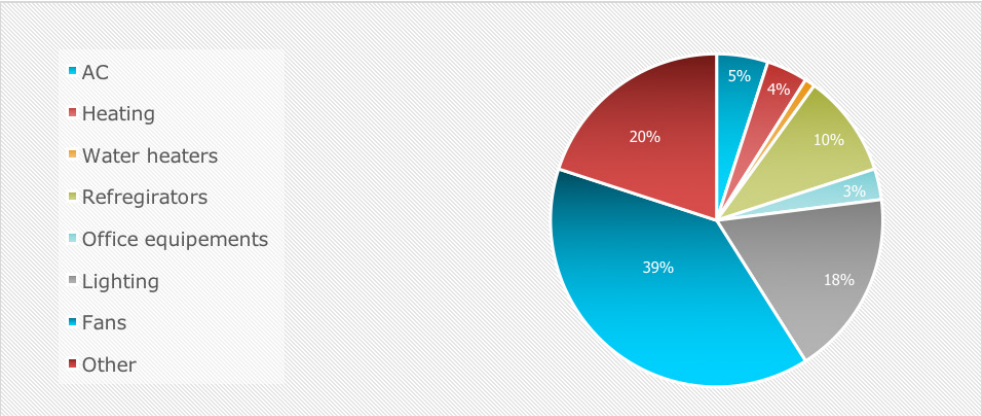
With regards to the electricity consumption in the main economic sectors in Jordan, figure 30 below shows that the residential sector always had the biggest share of the electricity consumption among all sectors in the past years. The average share of the electricity consumption in the residential sector in the period between 2010 and 2017 was around 43%. This share was followed by the industrial sector 27%, commercial sector 21% and agricultural sector 16%.

Figure 30: Electricity Consumption Share per sector (2010-2017). Source: (IEA, Statistics, 2010-2017)



Given the increase of the appliances share in households, particularly in the modern houses, appliances' electricity consumption represents the majority of electricity consumption in the residential sector (RCREEE, 2012). In Jordan, electric fans have the biggest share of electricity consumption among all appliances in the residential sector. In addition, 69% of households own electric fans as Jordanians mainly depends on fans for cooling. It is estimated that there are 2.2 million fans in the country. As shown in Figure 31 below, other appliances also have a considerable share of the consumption; lighting lamps 20%, refrigerators 10% and heating 5% (Nsour, 2015)

Figure 31: Appliances share from the total electricity consumption in the residential sector in Jordan (Nsour, 2015)



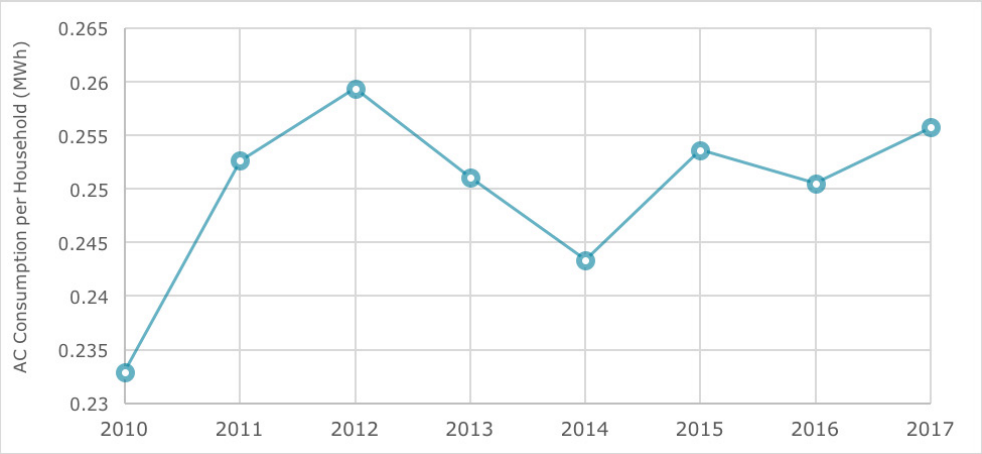
As most Jordanians live in areas with higher altitudes and cooler climates, only 27% of the households owns AC units with an overall of 573,400 units. It is worth mentioning that 40% of these ACs have a capacity of one ton or less and 39% of them are older than 5 years (Nsour, 2015).

Assuming that 27% of Jordanian electricity subscribers in the residential sector own AC units, the number of AC owners increased from 3,447,90 in 2010 to 4,860,00 in 2016, which is a conservative estimate. Figure 32 shows the number of the subscribers owning ACs (Own calculations).

Figure 32: Number of subscribers who own an AC unit in Jordan

Focusing now on the AC consumption trend per HH in Jordan, we can see in Figure 33, it increased from 2010 to 2017 with an overall growth rate of 10% moving from 0.23 MWh in 2010 and reaching 0.25 MWh per HH is 2017. It is worth noting that it witnessed a sharp decrease in 2013 despite the continuous increase in the residential electricity consumption and the number of dwellings in the country in this year. This can be easily justified by the fact that the increase in the number of dwellings in this year surpassed the electricity consumption.

Figure 33: AC consumption per households in Jordan (AUE, Statistical Bulletin, 2012-2017; RCREEE, 2012)



2.3.3. Relevant Insights for Assessing the Appliances

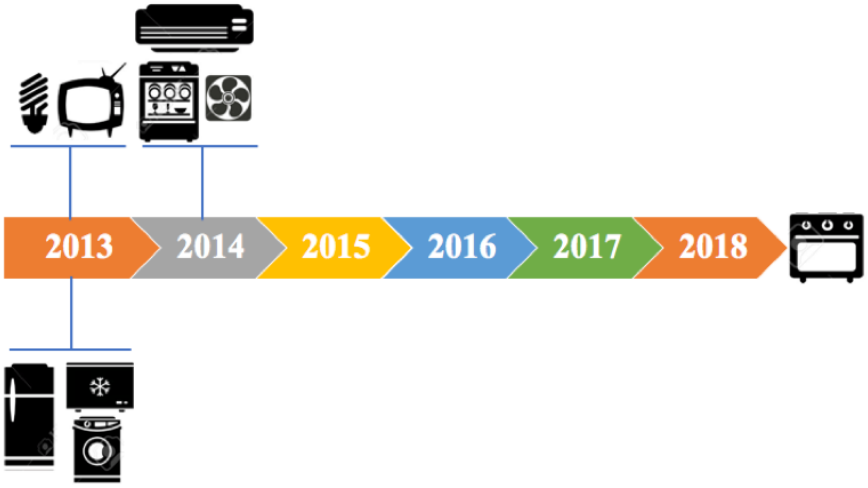
Jordan has adopted considerable labeling programs and MEPS for a number of appliances. In the past years, 8 electric appliances have been entitled for MEPS an labeling: AC units are one of these appliances. The following table summarizes all the appliances that have MEPS and labeling programs.

Table 3: MEPS, Labels and standards and their status in Jordan, source (RCREEE Data, 2019)

	MEPS		S&L		
Appliances	Current Status	Regulation Type	Current Status	Regulation Type	Policy Type
Lighting	In place	Mandatory	In place	Mandatory	Comparative
Refrigerators	In place	Mandatory	In place	Mandatory	Comparative
Freezers	In place	Mandatory	In place	Mandatory	Comparative
AC Units	In place	Mandatory	In place	Mandatory	Comparative
Electric Water heater	-	-	-	-	-
Solar Water Heaters	-	-	In place	Voluntary	Comparative
Electric ovens for food	Under development	-	Under development	-	-
TV	In place	Mandatory	In place	Mandatory	Comparative
Washing machines	In place	Mandatory	In place	Mandatory	Comparative
Fans	In place	Mandatory	-	-	-
Dishwashing machine	In place	Mandatory	In place	Mandatory	Comparative

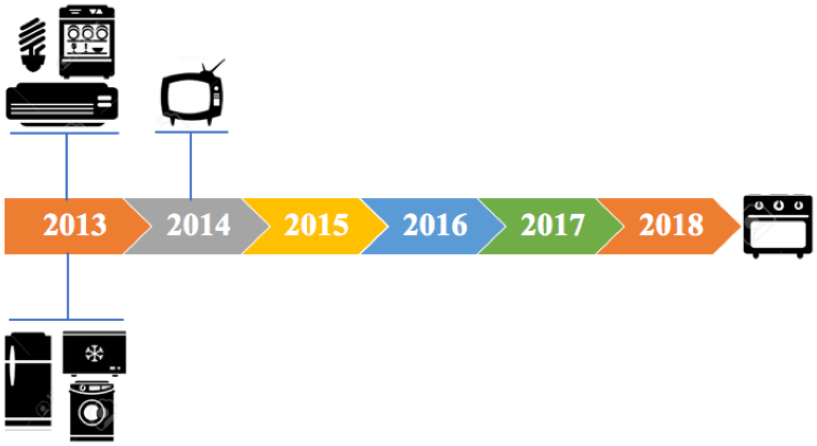
In 2013, Jordan started adopting MEPS for five appliances, which are washing machines, freezers, refrigerators, lighting and TV. In the following year (2014), also the MEPS expanded to cover three other appliances one of them is AC units. The timeline below shows when which MEPS has been adopted.

Figure 34: Timeline for adopting MEPS for appliances, Source: (CLASP, 2018)

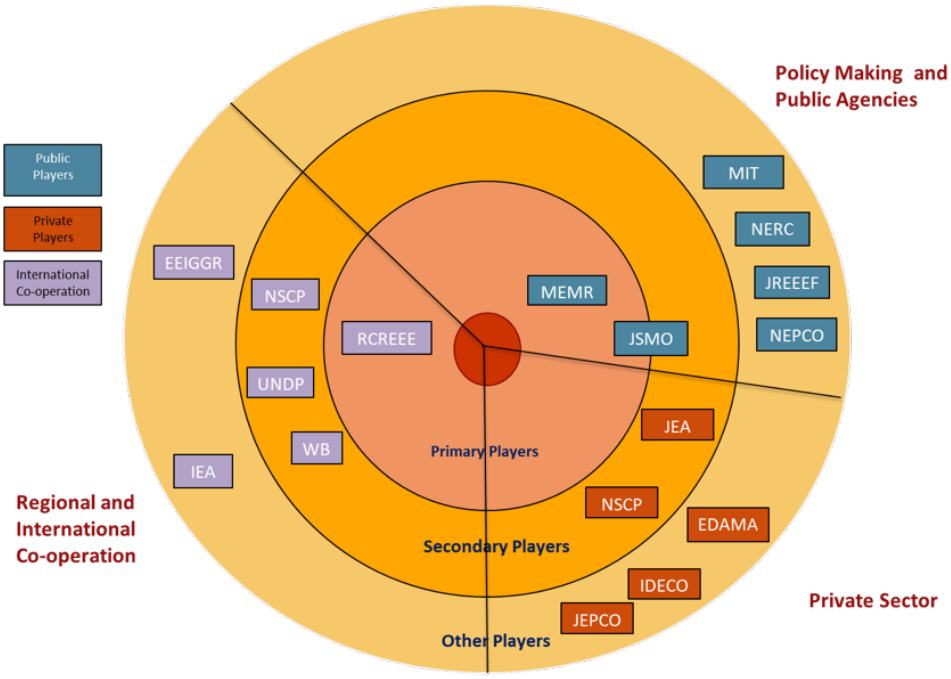


The timeline below also illustrates that all labels and standards including the AC labels and standards have been adopted in 2013, except for TV that was adopted in 2014. It is worth mentioning that the labels and MEPS of the electric ovens for food are currently under development and expected to be adopted during the next period.

Figure 35: Timeline for adopting Labels and Standards for Appliances



2.3.4. Key Stakeholders for Policy Design and Implementation



For the key players, the Ministry of Energy and Mineral Resources comes at the top of the primary players, followed by the Jordan standards and metrology organization that partly falls among the primary and secondary players. Among the other players, and unlike the other countries in the region, Jordan has three national players that are affecting EE in the country such as JEPCO, IDECO and EDAMA.

2.4. Detailed Country Profile: Lebanon

2.4.1. Country Overview

In the last years, Lebanon paid great attention to reduce the energy demand. In 2010, Lebanon started developing its first National Energy Efficiency Action plan (NEEAP) for the period 2011 to 2015. This plan was also followed by the second NEEAP that covered the period 2016 to 2020. Through these NEEAPs, Lebanon has set ambitious energy efficiency targets, initiatives and measures that seek to reduce the energy consumption within different sectors including the residential sector (LCEC, 2016).

2.4.2. Country's Analysis

The population witnessed high growth rate in the last five years, as it reached 15.5%. As a consequence of the war in Syria, Lebanon received a considerable number of refugees that increased the population from 4.9 million in 2012 to 6.1 million in 2017. Moreover, around 70% out of the total population in Lebanon are living in the urban areas (Worldometers, 2018). In 2009, 43% of dwellings out of 930,500 were located in the governorate of Mount Lebanon with the largest part of the population. Governorate of North was considered as the second governorate in terms of the number of population and dwellings: it represents 18% of the dwellings and 20% of the population, followed by governorate of Bekaa (Najwa Yaacoub & Lara Badre, 2012). In the last few years, the country's Gross Domestic Product (GDP) moved from around USD 44 billion in 2012 to USD 51.84 billion in 2017, reflecting a growth rate of 18.16% as shown in figure 36. As for the GDP per capita, figure 37 shows the gradual decline it witnessed in the period between 2012-2016. In 2012, the GDP per capita was USD 8,917 and fells to USD 8,253 in 2016. This continuous decrease in the GDP per capita in Lebanon, till 2016, simply shows that the population increase in the country surpassed the GDP increase till 2016. In 2017, there is noticeable increase in the GDP as shown in figure 36 and consequently an increase in the GDP per capita in the same year, as per figure 37 (World Bank, 2017).

Figure 36: GDP vs Population in Lebanon, Source: (World Bank 2012-2017)

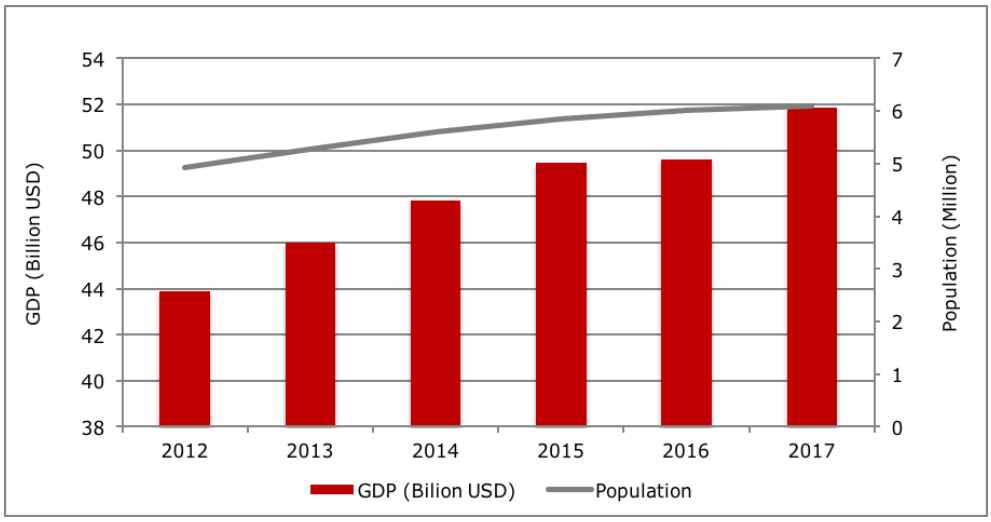
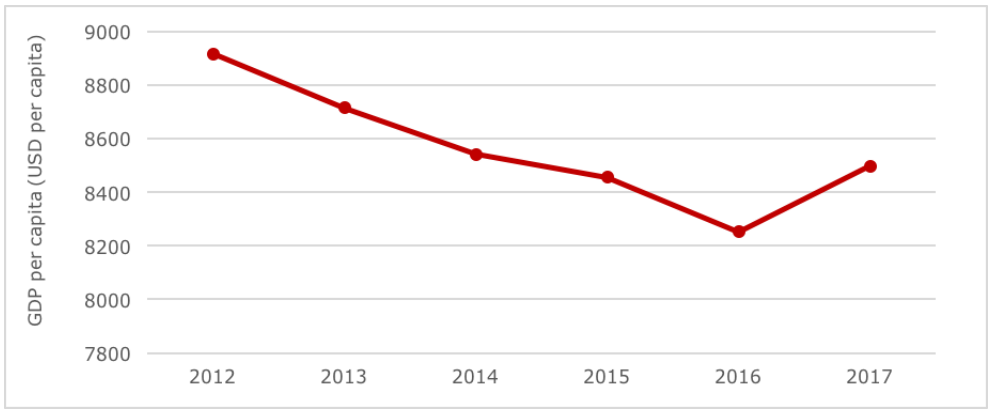
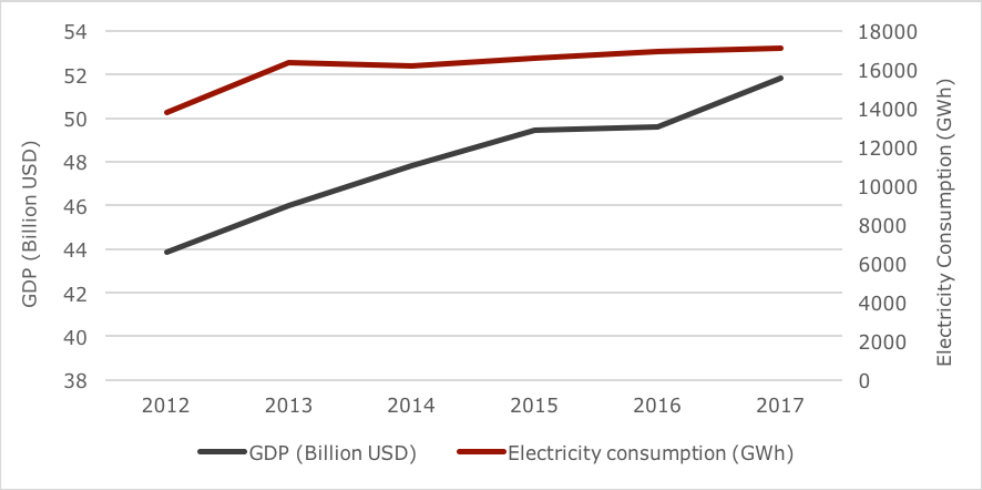


Figure 37: GDP per capita (USD) in Lebanon (World Bank, 2012-2017)



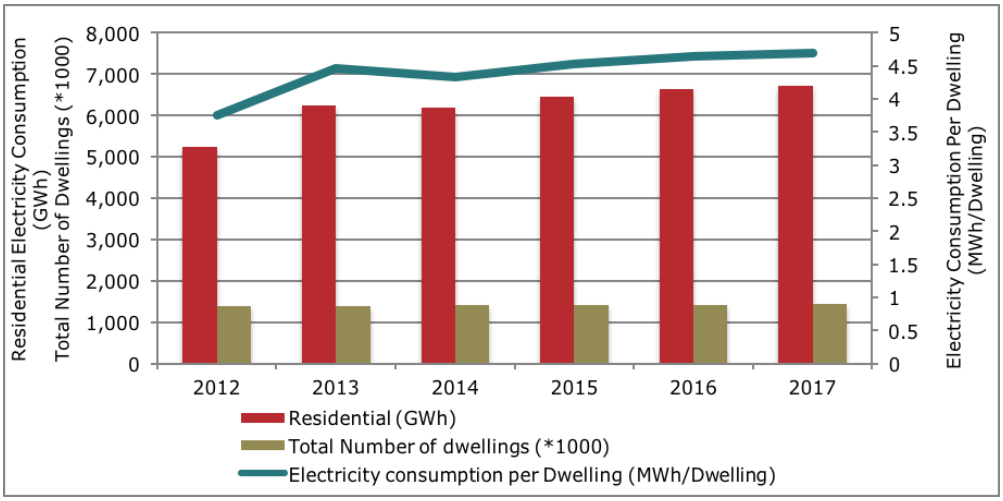
Electricity has a strong relationship with the economy as it is considered the backbone of the country's development. The GDP as mentioned earlier was increasing during the period 2012-2016 but this increase was accompanied by growing electricity consumption rates. Starting from 2012, the electricity consumption increased dramatically, especially between 2012 and 2013. The total consumption in 2012 was 13,776 GWh then it increased to 16,358 GWh in 2013. This increase represents 18.7% and the consumption in the following years was slight compared to 2013, as it reached 17,093 GWh in 2017. Figure 38 shows the relationship between the GDP and the electricity consumption (IEA, Statistics, 2012-2017 and World Bank, 2012-2017).

Figure 38: GDP vs Electricity Consumption (World Bank, 2012-2017) (AUE, Statistical Bulletin, 2012-2017)



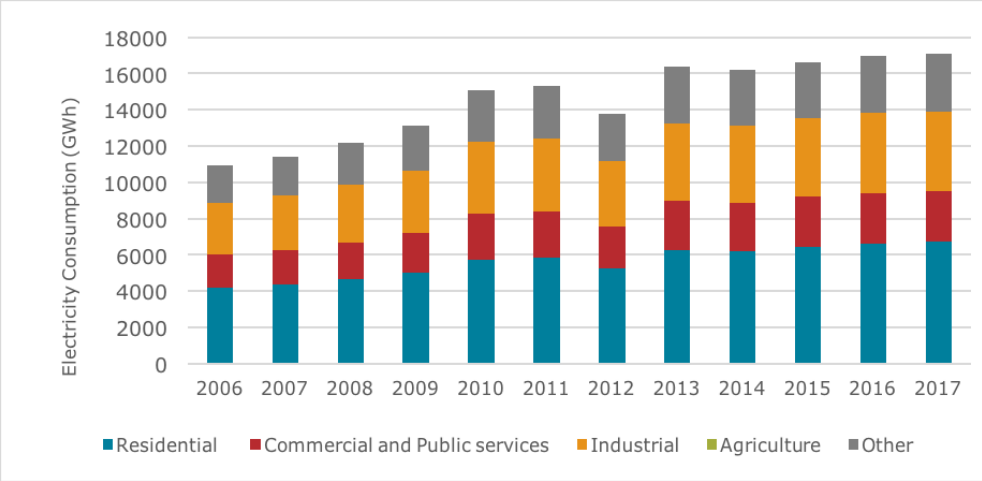
The average electricity consumption per each residential subscriber witnessed a considerable increase between 2012 to 2017. In 2012, the average consumption per dwelling was 3.75 MWh compared to 4.69 MWh in 2017 with a growth rate of around 25%. This increase as shown in figure 39 was the result of several factors, including the large number of the Syrian refugees in the country, the natural increase of the local population and the increase of appliances usage (AUE, Statistical Bulletin, 2012&2017 and IEA, Statistics, 2012&2017).

Figure 39: Electricity consumption per dwelling in Lebanon (IEA, Statistics, 2012-2017) (AUE, Statistical Bulletin, 2012-2017)



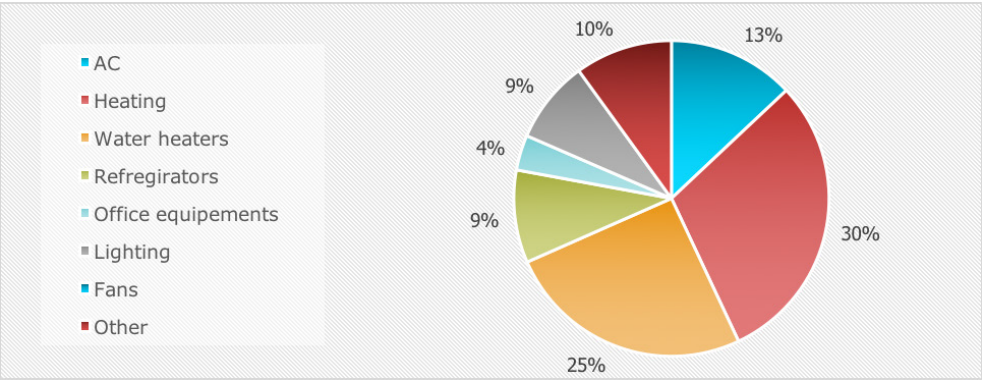
Over the past years, the residential sector in Lebanon was the first sector in terms of the electricity consumption compared to the other sector, around 40% of the electricity was consumed by the residential sector in 2017 while the consumption shares of the industrial and commercial sectors were 26% and 16% respectively. The bar column below illustrates the electricity consumption over the last 12 years (IEA, Statistics, 2010-2017).

Figure 40: Electricity consumption per sector in Lebanon (IEA, Statistics, 2006-2017)



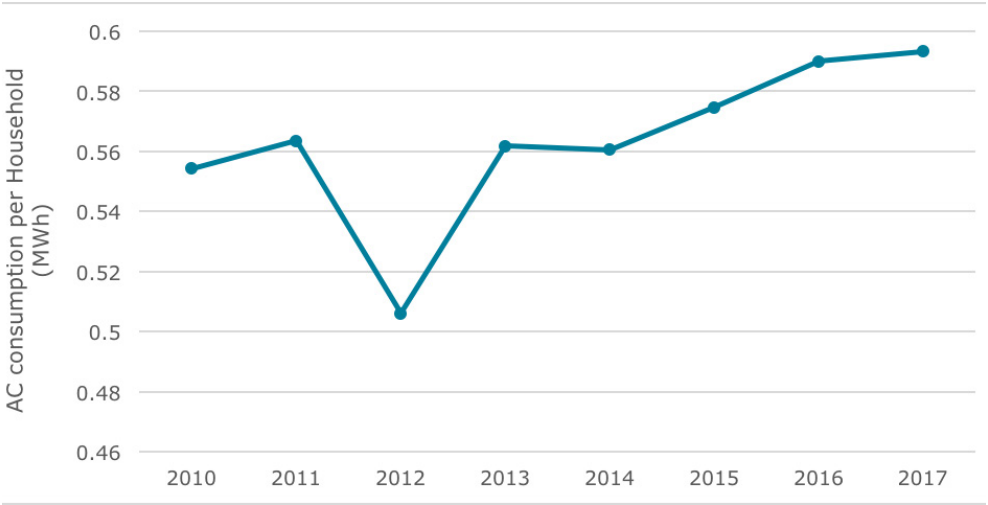
Electric appliances are considered the main consumers of the electricity in the residential sector. Heating devices, in 2010, had the largest share of the electricity consumption as it consumed 30%, followed by water heaters 25.4% and AC 13%. These appliances represent the top 3 appliances in terms of the electricity consumption in Lebanon. The pie chart below shows the consumption share of each appliance (RCREEE, 2012).

Figure 41: Appliances consumption share from the total electricity consumption in the residential sector in Lebanon (RCREEE, 2012)



For the air conditioners, which is the focus of this report, NEEAP 2016-2020 referred to a study conducted in 2007 and estimated that around 42% of the Lebanese households have one air conditioner and, as average, each household has 2 air conditioners. Moreover, around 36% of the air conditioners were with a capacity of 9000 BTU. In addition to that, estimated that there are 881,998 air conditioners in the country, 98% out of them are split units and working as cooling and heating systems (LCEC, 2016). Considering that the ACs consumption represents 13% of the total consumption of the residential sector in 2010, it is estimated that in 2017 the share of AC consumption reached 0.59 MWh compared to 0.55 MWh in 2010. Regardless of a decline in AC unit's consumption occurred in 2012, AC unit's electricity consumption witnessed a steadily increase. The AC unit's consumption of the period 2010-2017 is shown in Figure 42 (IEA, Statistics, 2012&2016 and RCREEE, National programs for residential appliances energy efficiency in RCREEE Member States, 2012).

Figure 42: AC consumption per household (GWH) in the residential sector in Lebanon (RCREEE calculations)



2.4.3. Relevant Insights for Assessing the Appliances

According to NEEAP 2016-2020, Lebanon is planning to adopt MEPS and labels for five appliances by 2020. These appliances are the following: air conditioners, lamps, refrigerators, televisions, washing machines. Table 4 shows current status, regulation type of the appliances' MEPS, standards and labels (RCREEE consultations).

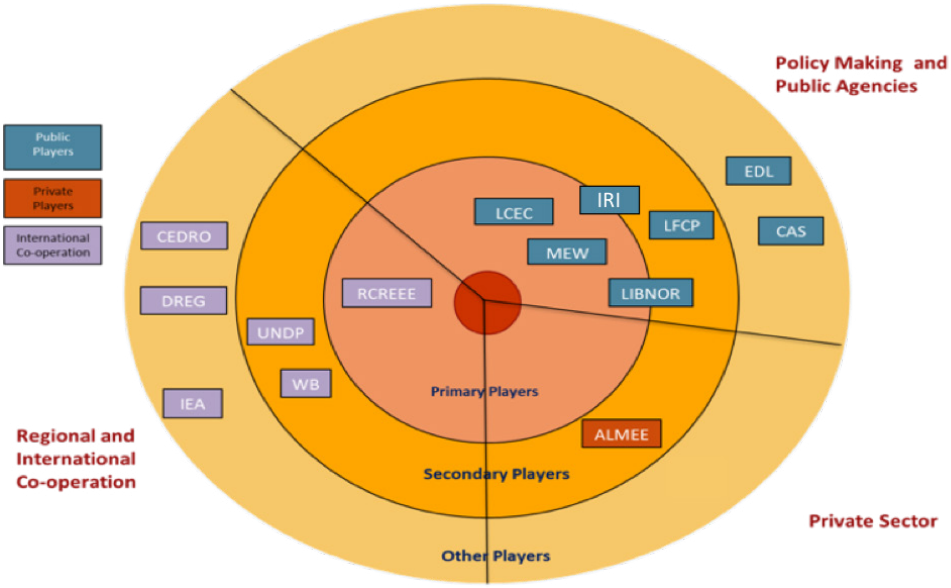
Table 4: MEPS / Labels and standards and their status in Lebanon. Source: (RCREEE Data, 2019)

	MEPS		S&L		
Appliances	Current Status	Regulation Type	Current Status	Regulation Type	Policy Type
Lighting	-	-	-	-	-
Refrigerators	Under development	-	Under development	-	-
Freezers	Under development	-	Under development	-	-
AC Units	Under development	-	Under development	-	-
Electric Water heater	-	-	-	-	-
Solar Water Heaters	-	-	-	-	-
Electric ovens for food	-	-	-	-	-
TV	-	-	-	-	-
Washing machines	-	-	-	-	-
Fans	-	-	-	-	-
Dishwashing machine	-	-	-	-	-

The diagram below shows the timeline for adopting the MEPS, Standards and Labels of the appliances.

Figure 43: Timeline for adopting MEPS and Labels for appliances. Source: (RCREEE consultations)

2.4.4. Key Stakeholders for Policy Design and Implementation



In Lebanon, the primary players are mainly the Lebanese Center for Energy Conservation (LCEC) as well as the Ministry of Energy and Water followed by LIBNOR and IRI, which fall between the primary and secondary players. Among the secondary players come, the LFCP, the WB and the UNDP. Finally, among the other players, we can find that in Lebanon, they also have some International players, such as the UNDP CEDRO and the UNDP DREG.

2.5. Detailed Country Profile: Libya

2.5.1. Country Overview

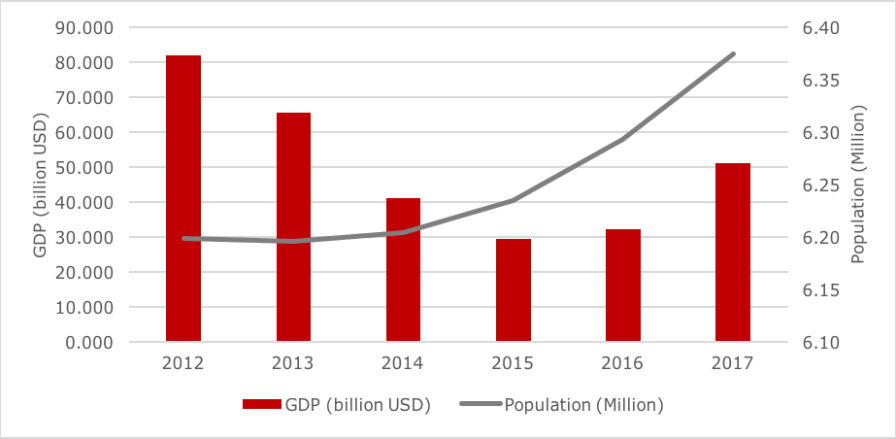
Since 2011 Libya is undergoing political unrest, the cost of which has taken a severe toll on the economic conditions leading to extended periods of recession and causing market disruptions due to shortage of supply for goods and services, which result in increasing the inflation rate and hence reducing the purchasing power of households (almost 80% less over the past 4 years cumulatively), among other factors (WBG, 2018). The electricity prices in Libya are one of the lowest in the MENA region, which indicates that significant subsidy reform for the energy sector is needed, together with the develoment and implementation of an energy efficiency strategy (AFEX, 2017). With regards to EE, the very low scoring for its policy framework and institutional capacity pushed the final index for Libya downwards, to be finally ranked as the lowest of the 20 investigated countries according to AFEX (2017). Furthermore, it is still lagging behind with regards to S&L and MEPS for different appliances.

Unfortunately, the current political situation in Libya contributed to lack of access to relevant information necessary for detailed analysis.

2.5.2. Country's Analysis

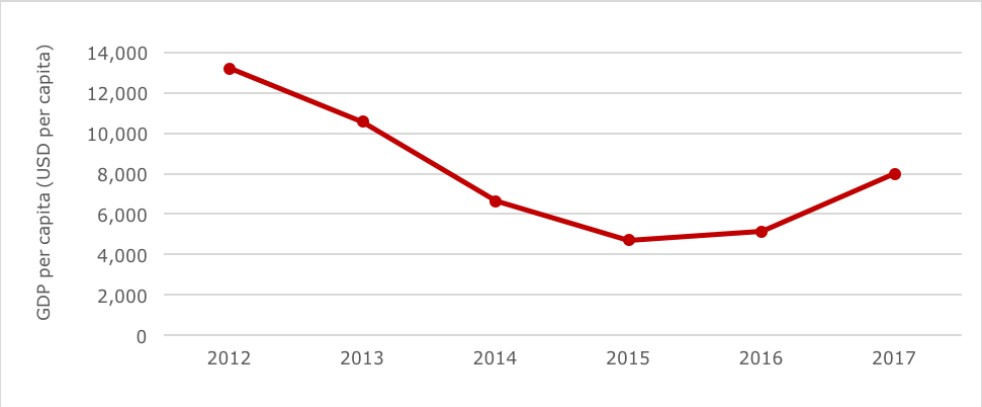
In 2017, the total GDP was USD 50.98 billion, reflecting a considerable growth rate of 58.06% compared to 2016 and per capita GDP of USD 7,998. As for total population, it was 6.37 million in 2017, indicating a growth rate of 1.27% compared to 2016. The GDP and population are illustrated in figure 44 (WBG, 2017).

Figure 44: GDP and Population in Libya from 2012 until 2017 (WBG, 2017)



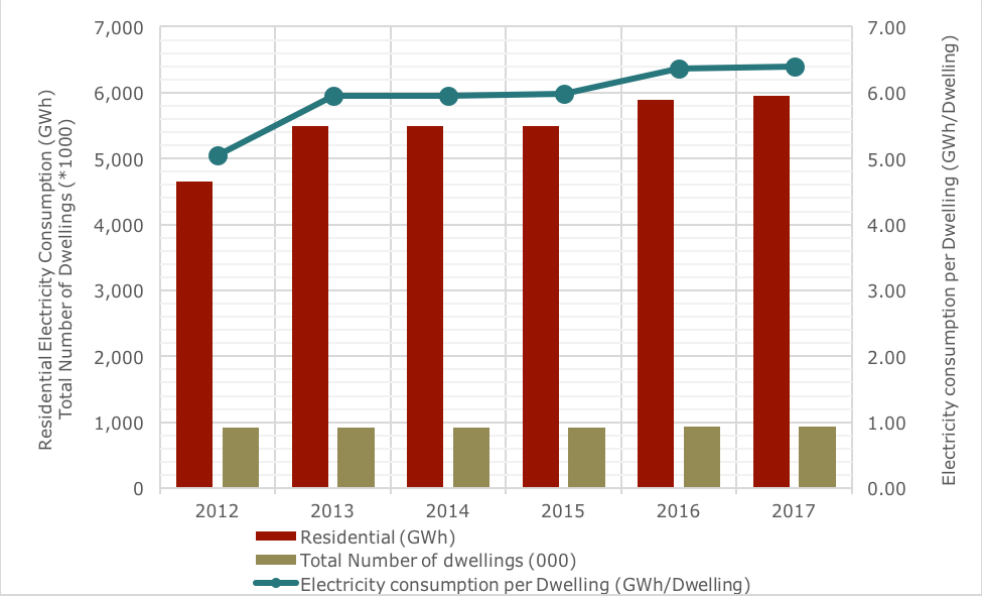
Furthermore, the trend of the GDP per capita for the period from 2012 until 2017 appears in figure 45, where the declining trend is clear until 2015, followed by recovery from 2016 onwards. Despite the remarkable increase in GDP per capita, it is still 39.5% less compared to the GDP per capita in 2012 of USD 13,209 (WBG, 2017).

Figure 45: GDP per Capita in Libya from 2012 until 2017 (WBG, 2017)



The population growth in 2017 was reflected also in the increase in the number of dwellings being around 0.93 million (AUE, 2017). Accordingly, the electricity consumption of the residential sector increased to be 5,953 GWh in 2017 (IEA, 2017), with an average share of 6.40 MWh per dwelling as illustrated in figure 46.

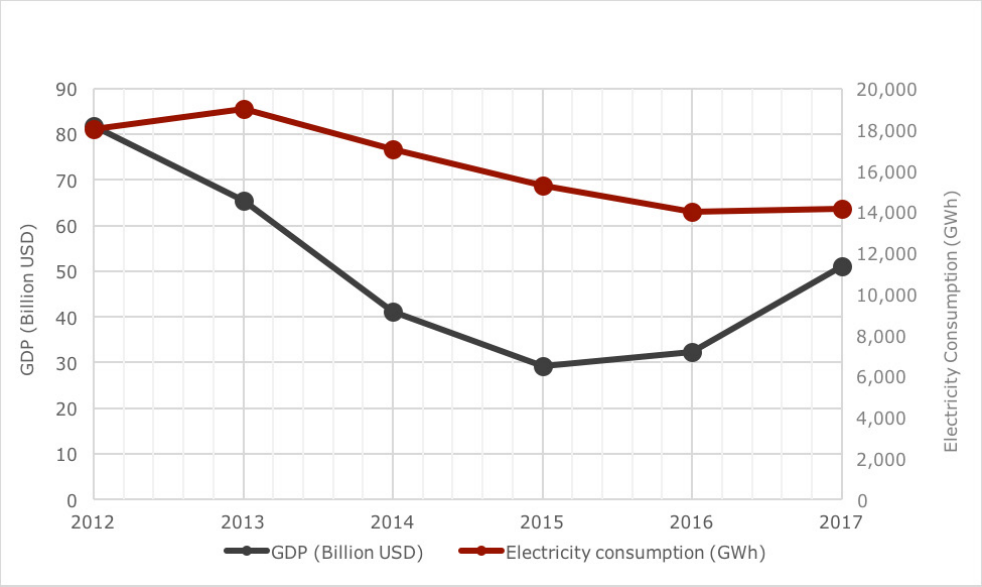
Figure 46: Electricity Consumption per Dwelling (MWh/dwelling) in Libya from 2012 until 2017



Although the electricity consumption per dwelling was almost steady over 3 years between 2013 and 2015, the trend started to increase in 2016. Compared to 2012, the overall growth rate in electricity consumption per dwelling is around 26.7%.

With respect to decoupling, the total electricity consumption from all sectors was increasing until 2013 then declined afterwards (IEA, 2017), while the GDP was decreasing at relatively lower rate until 2015, then took an upward trend afterwards, as clear from Figure 47.

Figure 47: Decoupling (GDP vs Electricity Consumption) from 2012 until 2017 in Libya

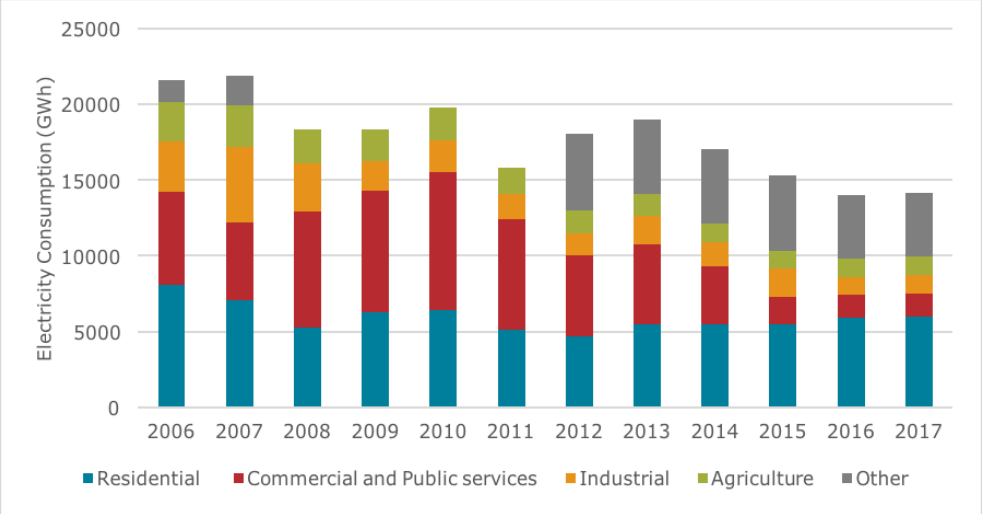


Libya is an energy exporting country and had a surplus of 600% of its domestic requirements from primary energy, with oil as its main energy production output. Other commonly used conventional energy are diesel and natural gas (WBG, 2017). Being almost entirely dependent on oil and gas exports, Libya has struggled since 2014 because of the political instability and disruption, as well as declination in global oil prices. Recently, the shortage of fuel necessary for power generation resulted in widespread electricity outages, accordingly affecting negatively the overall living conditions and access to vital services, such as clean water and health (CIA, 2018).

Problems related to operations and maintenance of the electricity plants, together with the political inconveniences were reported to have hindered the use of the electricity generation facilities (WBG, 2016). The total electricity generation from all sources was 36,767 GWh in 2017, only 8 GWh were from renewable (solar) energy (IEA, 2017), while the losses in electricity grid was reported to be around 20% (AUE, 2017).

The share of the main sectors in total electricity consumption appears in Figure 48 where the residential sector represent 42.16% of the total electricity consumption in 2017, thus ranking the highest among other sectors (IEA, 2017).

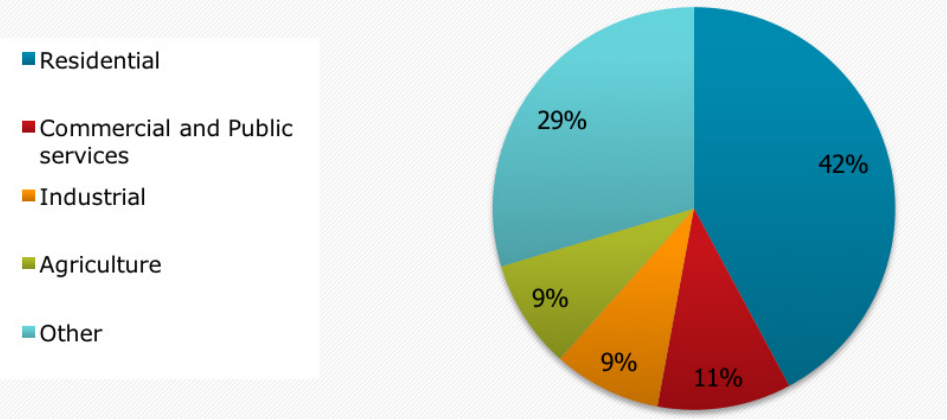
Figure 48: Electricity Consumption per Sector from 2006 until 2017 in Libya (IEA, 2017)



The growth rate per capita of the total electricity generation increased by 4.68% from 2012 until 2017, while the growth rate of the residential electricity consumption per capita increased by 24.81% for the same period. Accordingly, the electricity consumption per capita in the residential sector was 936.56 kWh in 2016, compared to total generation of 5,588.74 kWh per capita (IEA, 2017). The average size of household in Libya was around 5 to 6 people (UN, 2017).

In 2016, the peak period was reported to be in January (i.e. in winter for heating purposes), where actual peak load reached 7,383 MW (AUE, 2017). Figure 49 shows the share of electricity consumption per sector in 2017. The demand grew by 7.4% in the residential sector, compared to a reported decrease in electricity consumption for the industry, commercial and other sectors (IEA, 2017).

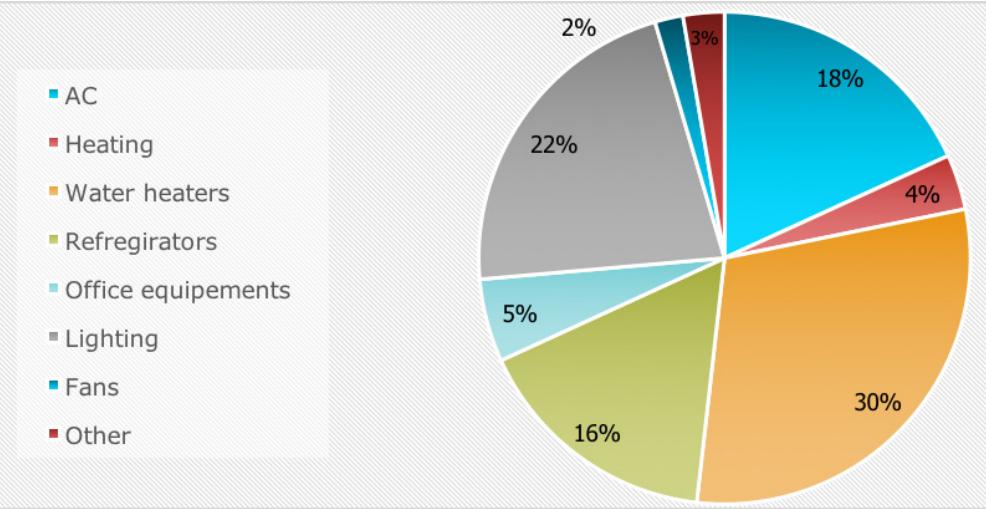
Figure 49: Electricity Consumption per Sector in 2017 in Libya (IEA, 2017)



In 2016, the electrification rate in Libya was 98.5% for both, rural and urban areas (WBG, 2017), which was steady over the last few years despite the on-going conditions and considering also the increase in the number of residential dwellings almost 1% for the same year causing relative increase in the electricity consumption per household by around 6.36% per year (AUE, 2017).

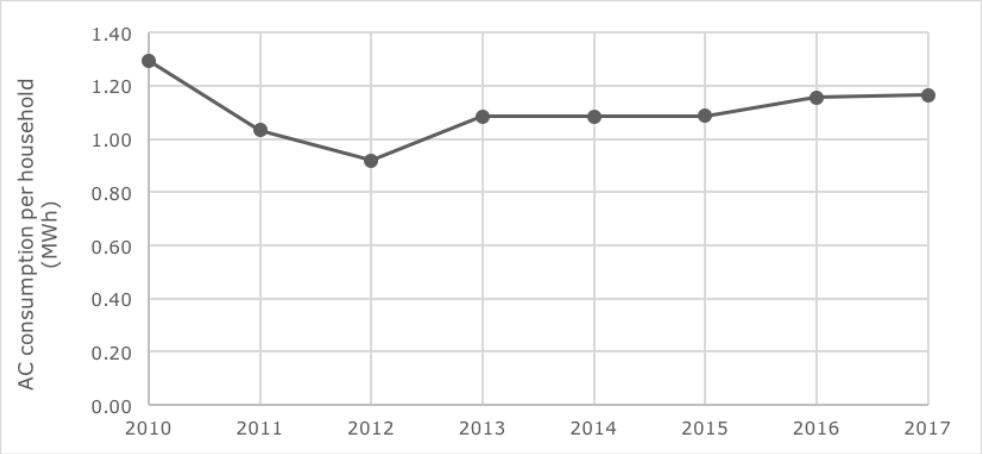
With regard to households' appliances, the respective share of the commonly used appliances from total electricity consumption in residential sector is depicted in Figure 50 showing that air conditioners rank the second highest with 18% of residential electricity consumption (RCREEE, 2012).

Figure 50: Share of Households' appliances in the Electricity Consumption for Residential Sector in Libya (RCREEE, 2012)



Building on these inputs to calculate the electricity consumption pattern for air conditioning per household and applying the annual growth rate for residential electricity consumption (assumption), the results illustrated in Figure 51 show slight changes from 2013 until 2015, with slight increase towards 2017.

Figure 51: Electricity Consumption for Air Conditioners (MWh) per Household in Libya



Obviously, the demand for electricity grew during the last decade due to different electricity uses for lighting, appliances (such as refrigerators, television, washing machines, etc.), as well as information and communication technologies (electronic equipment) and air conditioning (MEDENER, 2013). Should the current consumption pattern of air conditioners continue in Libya, the annual energy consumption of room air conditioners is expected to reach 1,910 MWh by 2030, thus the potential of energy savings is high if measures for energy efficiency are considered (U4E, 2018).

In general, Libya is still lacking plans and laws for energy efficiency, as well as enforcement power of institutional capacity to implement significant reform in its energy sector (AFEX, 2017).

2.5.3. Relevant Insights for Assessing the Appliances

Libya is undergoing the process of drafting a National Energy Efficiency Action Plan (NEAP), including short term actions and measures to reduce electricity consumption (in buildings and public sector), while the medium term actions proposed the certification of electrical household appliances (WBG, 2016).

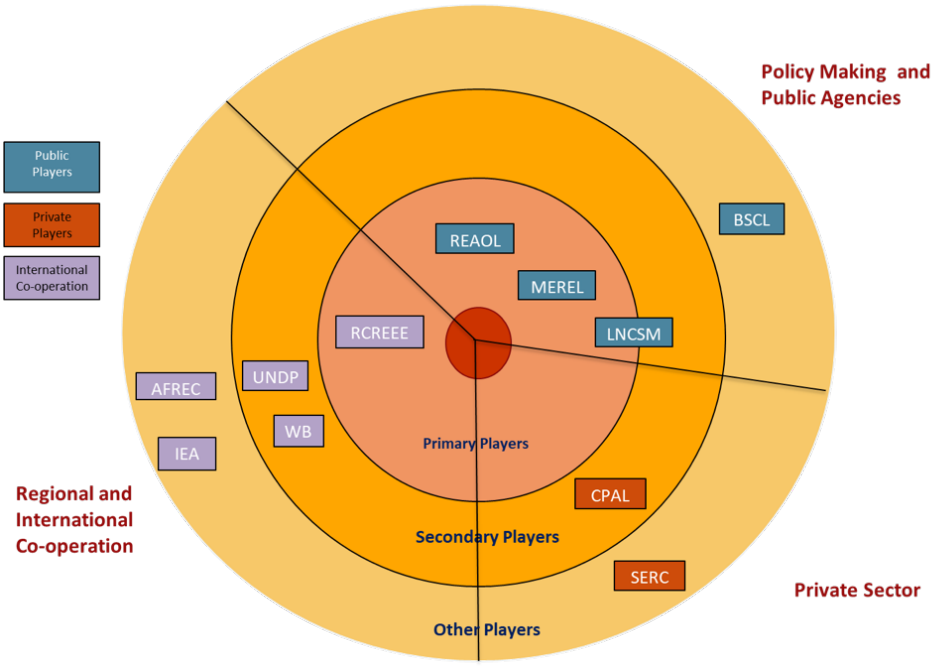
For the sake of this report, there was no available data on MEPS, standards and labels for households' appliances, except for energy labelling for household electric (incandescent) lighting bulbs, which has been adopted since 2014. In addition, a scrapping program has been implement to replace electric water heaters with solar water heaters since 2014. No information was available

about the presence of testing laboratories for commonly used appliances. Table 5 shows the status of MEPS, standards and labels for the common appliances in households.

Table 5: Status of MEPS, Standards and Labels for Appliances in Libya

	MEPS		S&L		
Appliances	Current Status	Regulation Type	Current Status	Regulation Type	Policy Type
Lighting	In place	-	-	-	-
Refrigerators	-	-	-	-	-
Freezers	-	-	-	-	-
AC Units	-	-	-	-	-
Electric Water heater	-	-	-	-	-
Solar Water Heaters	-	-	-	-	-
Electric ovens for food	-	-	-	-	-
TV	-	-	-	-	-
Washing machines	-	-	-	-	-
Fans	-	-	-	-	-
Dishwashing machine	-	-	-	-	-

2.5.4. Key Stakeholders for Policy Design and Implementation



2.6. Detailed Country Profile: Morocco

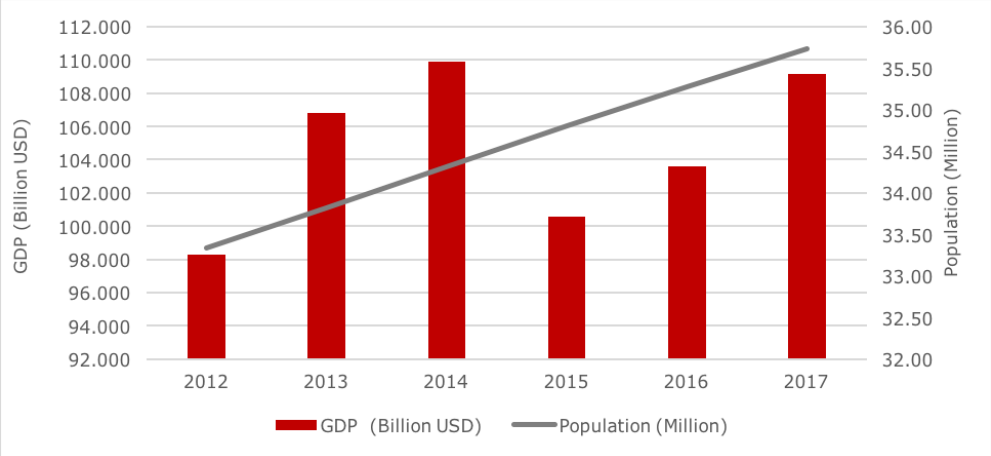
2.6.1. Country Overview

The Kingdom of Morocco is one of leading countries in deploying clean energy technologies and has abundant renewable energy resources (mainly solar, wind and hydro-power). Although it is highly dependent on imported fuel for its energy needs, Morocco was among the first countries in the Middle East and North Africa (MENA) to cut fossil fuel subsidies. The Government has taken serious steps to diversify its energy mix especially for electricity purposes and identified the energy efficiency as a national priority. For that, a comprehensive plan was adopted to significantly improve energy efficiency (IEA, 2018). These collective efforts led Morocco to rank as third (out of 20 countries) with regards to EE index (AFEX, 2017).

2.6.2. Country's Analysis

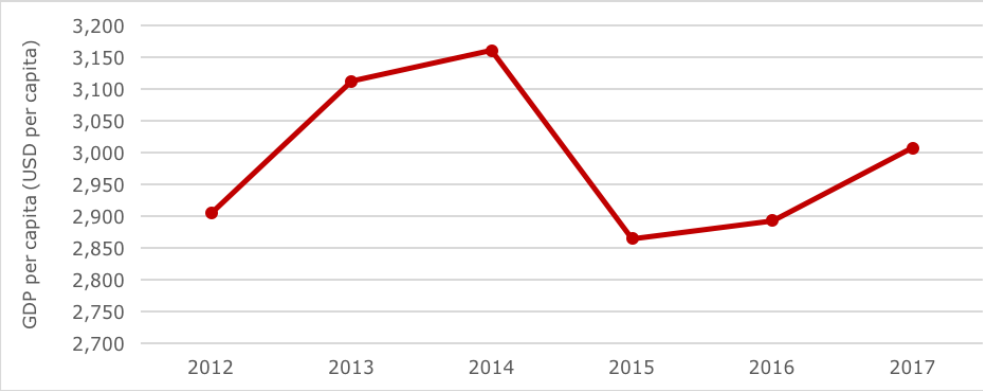
In 2017, the total GDP was USD 109.14 billion, reflecting 5.34% growth rate compared to 2016 and per capita GDP of USD 3,007. The total population was 35.74 million, showing a growth rate of 1.31% compared to 2016 and 7.2% compared to 2012, as presented in Figure 52 (WBG, 2017).

Figure 52: GDP and Population in Morocco from 2012 until 2017 (WBG, 2017)



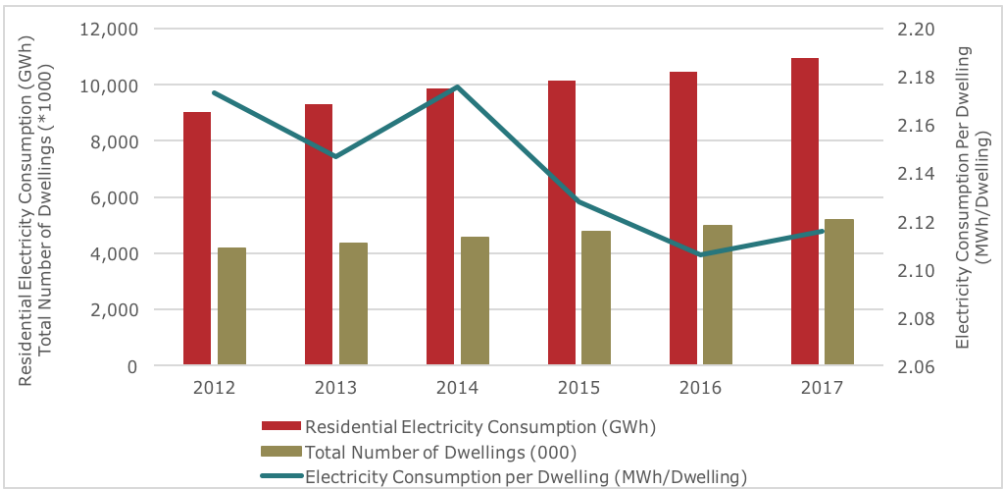
The trend of the GDP per capita for the period from 2012 until 2017 appears in Figure 53, where a clear drop was depicted in 2015, followed by recovery from 2016 onwards. Considering 2012 as the base year, the overall growth rate for the GDP per capita was around 3.5% in 2017 (WBG, 2017).

Figure 53: GDP per Capita in Morocco from 2012 until 2017 (WBG, 2017)



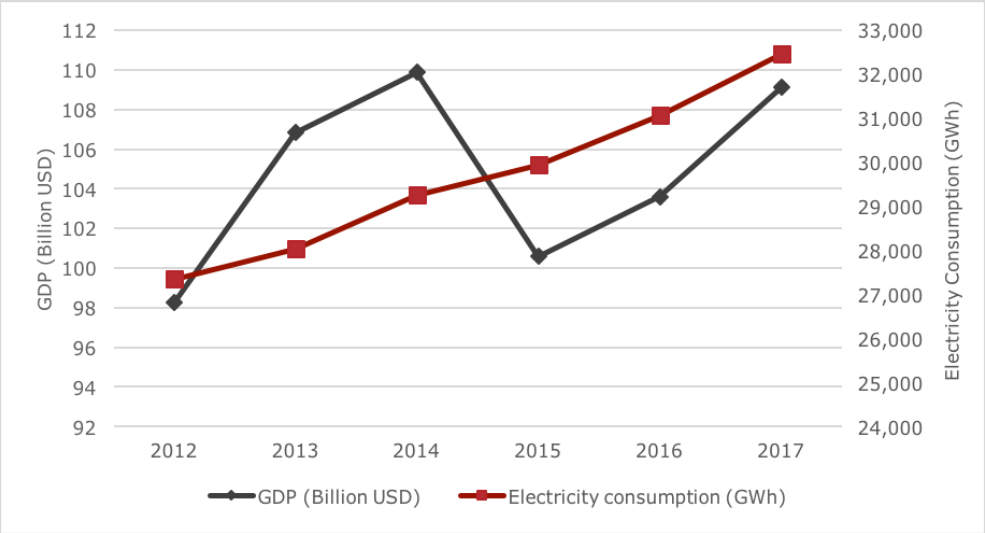
The increase in population resulted in an increased number of dwellings of around 5.18 million in 2017 (AUE, 2017), which accordingly caused an increase in the electricity consumption of the residential sector of 10,960 GWh in 2017 (IEA, 2017), with an average share of 2.12 MWh per dwelling as illustrated in Figure 54. Nonetheless, the electricity consumption per dwelling shows a decreasing trend in 2015 and 2016, and overall around a 3.09% decrease compared to 2012.

Figure 54: Electricity Consumption per Dwelling (MWh/dwelling) in Morocco from 2012 until 2017



As far as decoupling is concerned, Figure 55 shows that the total electricity consumption from all sectors was continuously increasing over the period 2012 – 2017 (IEA, 2017), while there was a drop in GDP between 2014 and 2015 followed by an increase between 2015 and 2017.

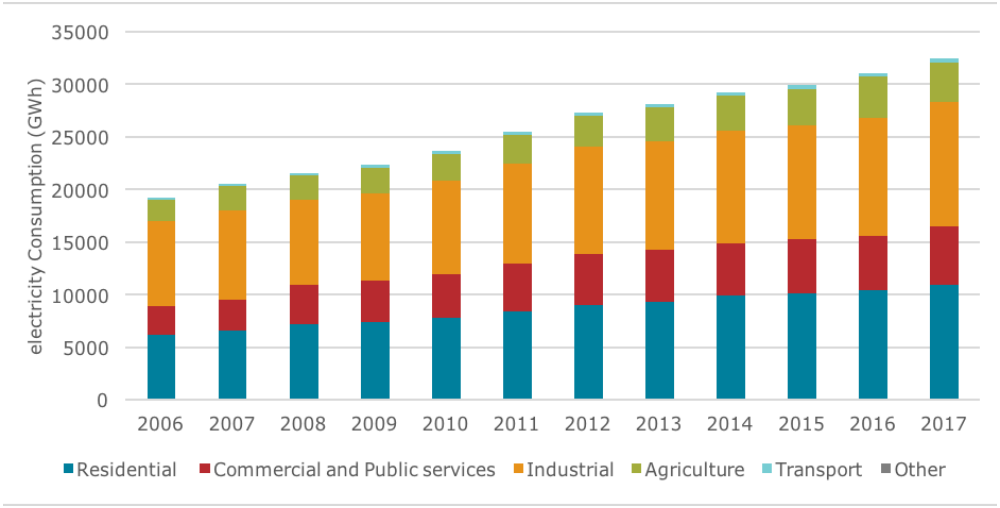
Figure 55: Decoupling (GDP vs Electricity Consumption) from 2012 until 2017 in Morocco



Morocco is an energy (oil) importing country, since it supplies only 6.4% of its own energy requirements. Therefore, reducing energy dependence is one of its strategic priorities. The common conventional energy are fuel oil, coal, natural gas and diesel (WBG, 2016). According to IEA, the total electricity generation from all sources was 32,141 GWh in 2016, 9% of which were from coal-fired power plants (WBG, 2016) while the losses in electricity grid was reported to be around 21.5% (AUE, 2017).

The share of the five main sectors in total electricity consumption appears in Figure 56, where the residential sector represents almost one third of the total electricity consumption throughout the period from 2006 until 2017 (IEA, 2018).

Figure 56: Electricity Consumption per Sector from 2006 until 2017 in Morocco (IEA, 2017)

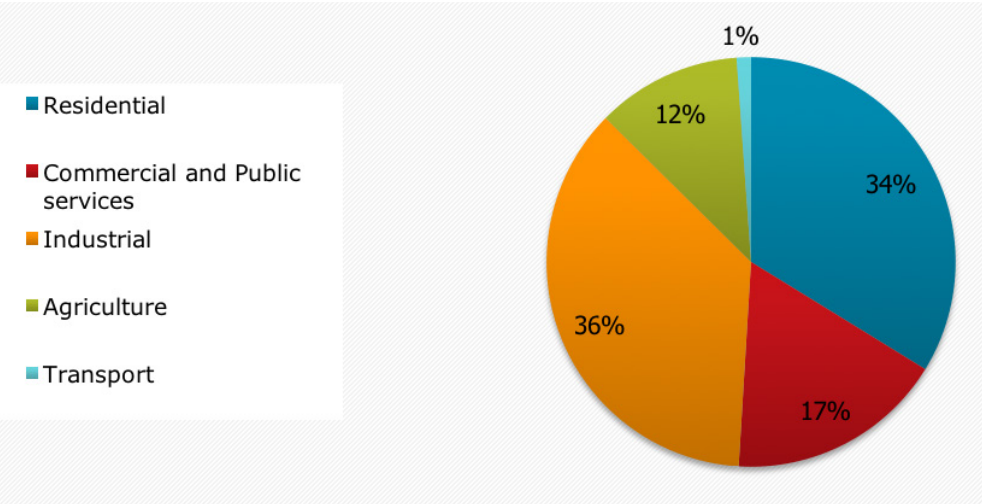


The growth rate of the total electricity generation (from conventional and renewable energy sources) increased by 10.36% per capita from 2012 to 2016, while the growth rate of the residential electricity consumption per capita increased by 9.45% for the same period. Accordingly, the per capita electricity consumption in the residential sector was 296.77 kWh in 2016, compared to total generation of 911.11 kWh per capita (IEA, 2017). In Morocco, the average size of household was around 5 people in 2010, where the AC consumption was 700 kWh for equipped households (i.e. the average electricity consumption for AC is around 140 kWh per person) (MEDENER, 2013).

The breakdown of electricity consumption per sector in 2017 is illustrated in Figure 57, which shows that the residential sector has the second highest share with 34% of electricity consumption in 2017. The peak period was reported to be July (i.e. in summer due to use of air conditioners), when, in 2017, the peak load reached 6,050 MW (AUE, 2017), to accompany the yearly growing demand of 6.2% mostly from the residential sector, compared to the industry and services sectors (WBG, 2016).

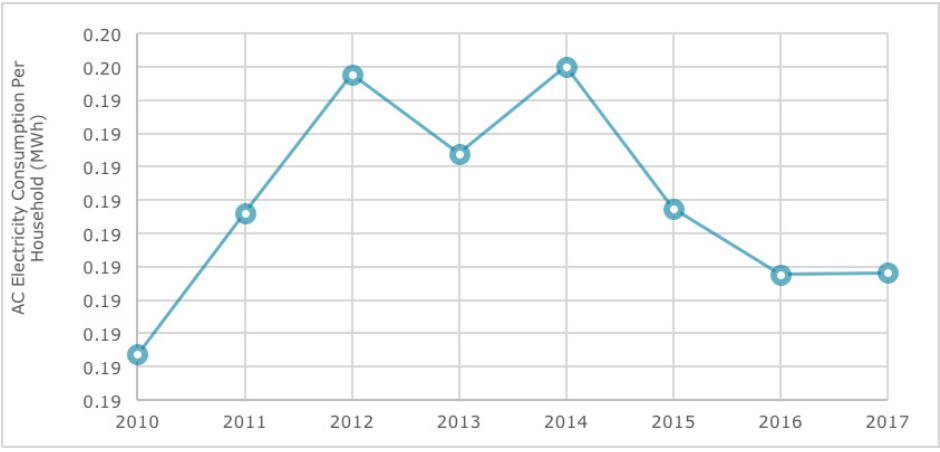
In 2010, the electrification rate in Morocco increased to 95%, resulting in significant increase in the electricity consumption per household by around 4% per year. This trend continued growing during the last decade due to different electricity uses for lighting, appliances (such as refrigerators, television, washing machines, etc.), as well as information and communication technologies (electronic equipment) and air conditioning (MEDENER, 2013).

Figure 57: Electricity Consumption per Sector in 2017 in Morocco (IEA, 2017)



Making the same assumption that the ACs' electricity consumption grows in direct proportion with the annual growth rate for residential electricity consumption, the pattern for AC electricity consumption was calculated. As shown in Figure 58, the electricity consumption of air conditioning per household has risen sharply from 2010 until 2014, yet the trend decreased towards 2017, probably because the increase rate in the number of dwellings (households) was higher than the one for electricity consumption during that period.

Figure 58: Electricity Consumption for Air Conditioners (MWh) per Household in Morocco



However, there is high potential for growth (MEDENER, 2013), especially with the increasing temperature in summer due to the climate change and global warming effects. If the current pattern of consumption continues in Morocco, the annual energy consumption of room air conditioners is expected to reach 4,300 GWh by 2030, thus the potential of energy savings is high if measures for energy efficiency are considered (U4E, 2018).

In general, Morocco targets to improve its energy efficiency by 12% by 2020 and 15% by 2030. Since 2014, the government has started implementing measures to reduce energy subsidies, and by end of 2015 gasoline and diesel prices were liberalized.

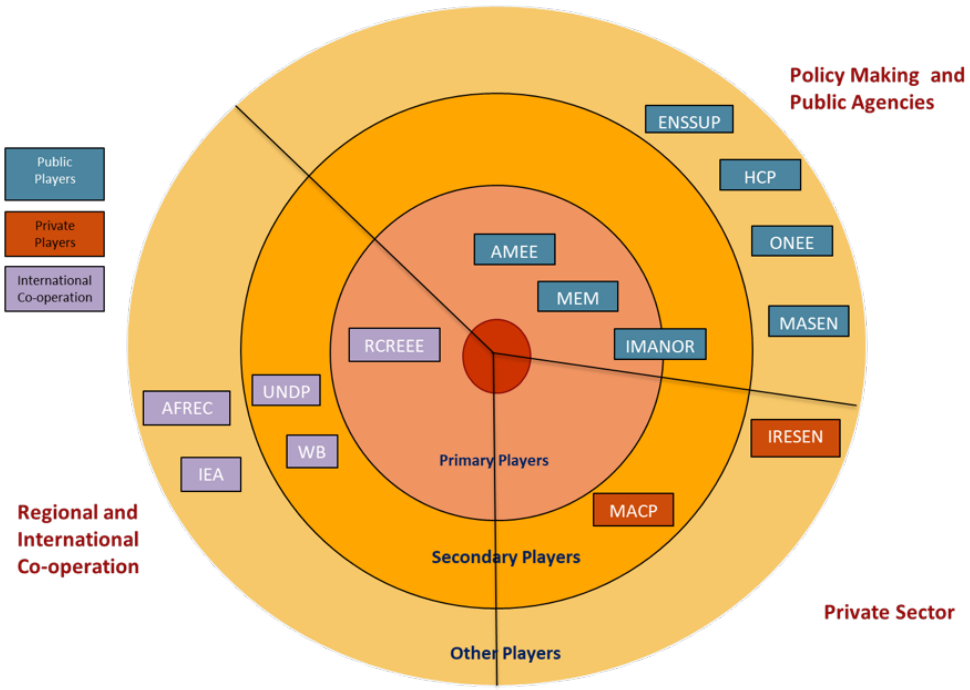
2.6.3. Relevant Insights for Assessing the Appliances

Morocco has adopted energy labeling for lighting bulbs and thermal regulations for construction. The country is currently developing MEPS and labels with the assistance of international financial institutions, such as EBRD that is supporting AMEE in drafting EE regulations for 3 home appliances. Within the same framework, the AMEE with EBRD's support is initiating the development of an MVE protocol for appliances. Table 6 below summarizes the status of MEPS, standards and labels for the common appliances in households.

Table 6: Status of MEPS, Standards and Labels for Appliances in Morocco

	MEPS		S&L		
Appliances	Current Status	Regulation Type	Current Status	Regulation Type	Policy Type
Lighting	-	-	In place	Mandatory	Endorsement
Refrigerators	under development	-	under development	-	-
Freezers	under development	-	under development	-	-
AC Units	under development	-	under development	-	-
Electric Water heater	-	-	-	-	-
Solar Water Heaters	-	-	-	-	-
Electric ovens for food	-	-	-	-	-
TV	-	-	-	-	-
Washing machines	-	-	-	-	-
Fans	-	-	-	-	-
Dishwashing machine	-	-	-	-	-

2.6.4. Key Stakeholders for Policy Design and Implementation



The chart above, illustrates the key players and stakeholders in Morocco. It is mainly divided into three layers: the primary players that mainly include the public players as MEM and AMEE, followed by the secondary players, including part of the private and international co-operation, such as the MACP, the WB and UNDP. Finally, a diversity of players from the private and public sector as well as international cooperation complete the picture.

2.7. Detailed Country Profile: Palestine

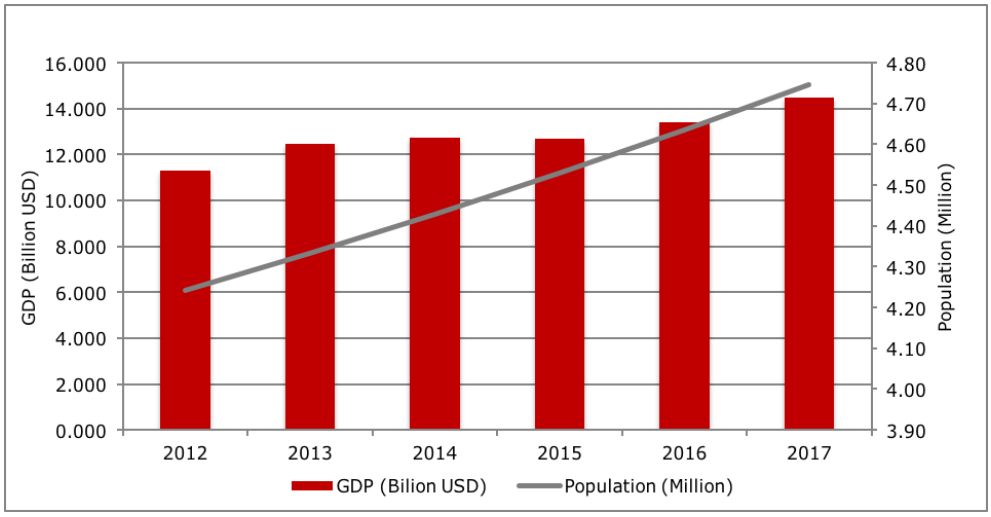
2.7.1. Country Overview

The economic situation in Palestine is fragile and more likely to be unsustainable because of the political conditions and lack of reconciliation, which is accordingly slowing down the economic growth and has negative impact on the living standards (CIA, 2018).

2.7.2. Country's Analysis

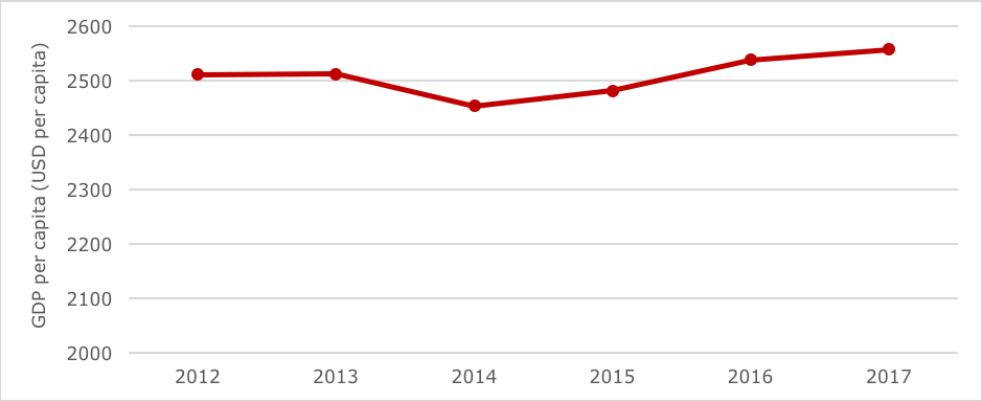
In 2017, the total GDP was USD 14.498 billion, reflecting the growth rate of 14.4% compared to 2015 and GDP per capita of USD 1,663. The total population was 4.75 million in 2017, showing a growth rate of 2.37% compared to the previous year, as illustrated in figure 59 (World Bank, 2012-2017).

Figure 59: GDP and Population in Palestine from 2012 until 2017 (World Bank, 2012-2017)



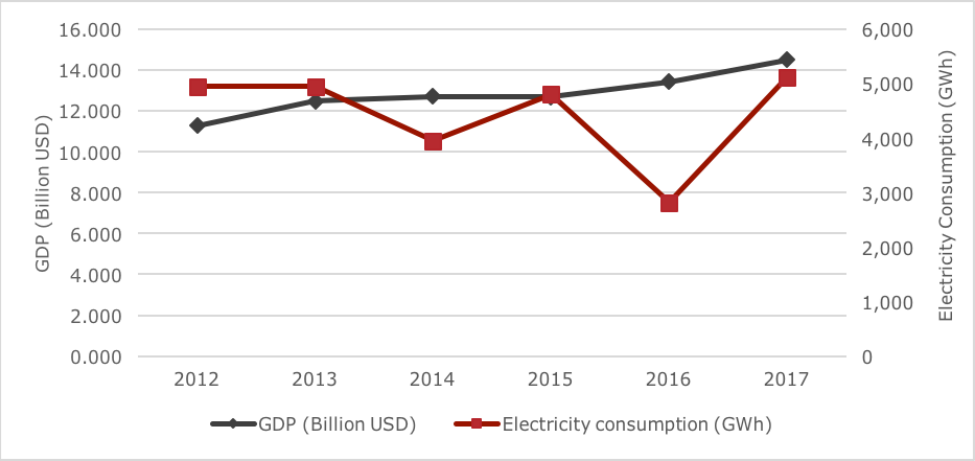
Furthermore, the trend of the GDP per capita for the period from 2012 until 2017 is shown in Figure 60, where a remarkable increase appears between 2013 and 2014, followed by an increasing trend at a relatively lower rate from 2015 onwards, since the population grew at a relatively lower rate than the one of GDP per capita. Considering 2012 as the base year, the GDP growth rate per capita was around 1.83 % in 2017 (World Bank, 2012-2017).

Figure 60: GDP per Capita in Palestine from 2012 until 2017 (Worldmeters, 2012-2017)



Although there is a correlation between economic growth and electricity consumption, the recorded data for 2016 showed a drop in the total electricity consumption to reach 2,822 GWh in 2016 after it was 4,800 GWh in 2015, then an increase in 2017 to 5120 GWh. The decoupling appears clearly in Figure 61.

Figure 61: Decoupling (GDP vs Electricity Consumption) from 2012 until 2017 in Palestine

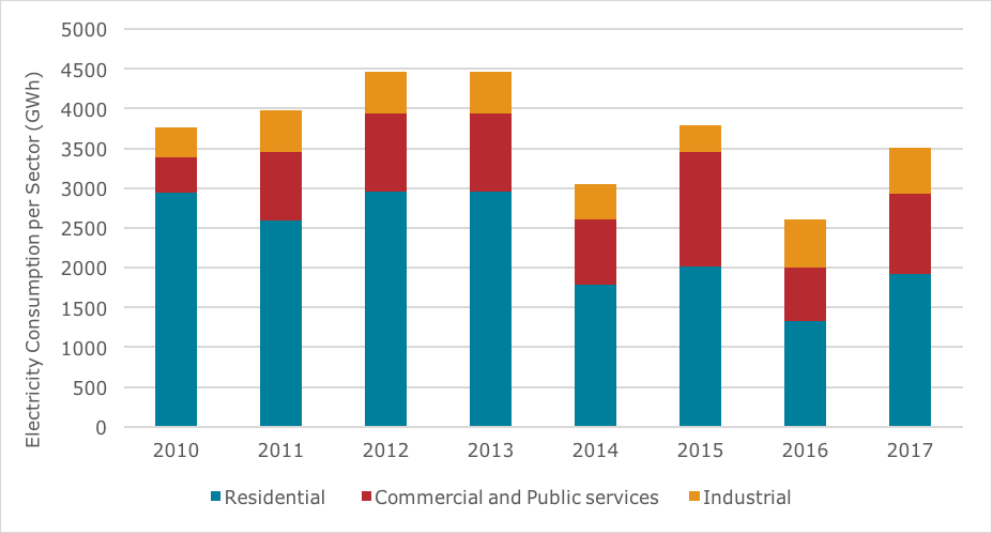


Regarding the total electricity generation from all sources, a sharp decrease was reported for 2016 to be only 156 GWh compared to 485 GWh in 2015. Having around 68% less electricity supply, and considering that the electricity grid losses was 23% (AUE, 2017), could justify the decrease in total electricity consumption referred to earlier (AUE, 2012-2017).

The share of the main sectors in total electricity consumption is depicted in

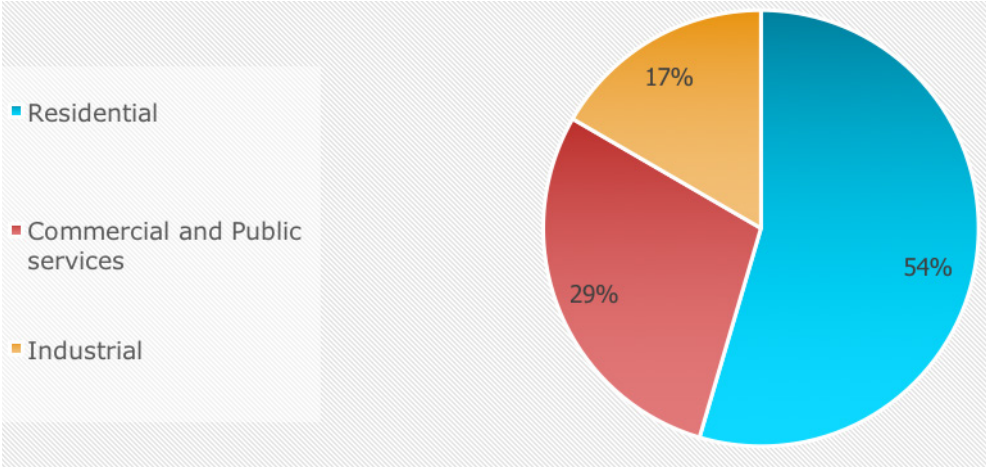
figure 62. It is clear that the residential sector represents the highest share among other sectors with almost 59% of the total electricity consumption for the period from 2010 until 2017 (AUE, 2010-2016).

Figure 62: Electricity Consumption per Sector from 2010 until 2017 in Palestine (AUE, 2010-2017)



The breakdown of electricity consumption per sector in 2017 is illustrated in Figure 63, which shows that the residential sector has the highest share with 54% of electricity consumption in 2017 (IEA, 2017).

Figure 63: Electricity Consumption per Sector in 2016 in Palestine (IEA, 2017)

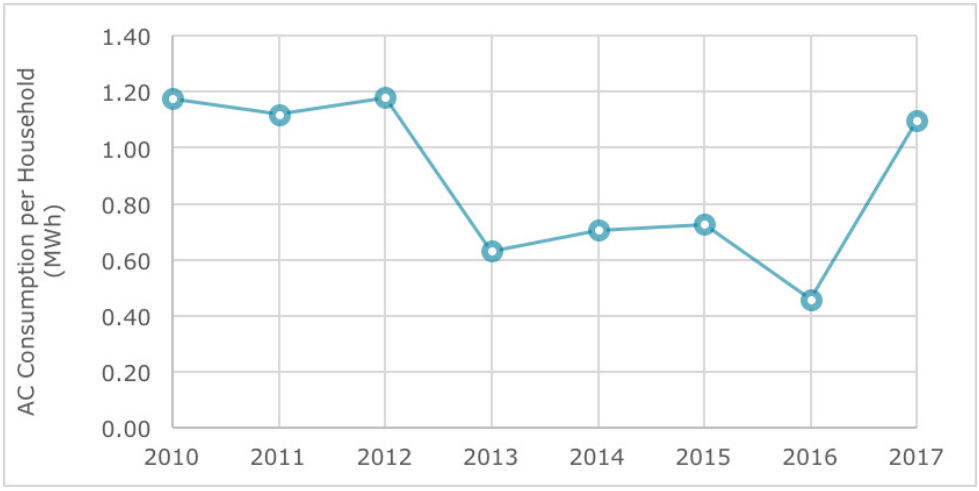


With regard to the residential sector, the changes in the total electricity generation and consumption resulted in decreasing the per capita share in 2016 to be 275.68 kWh and 32.43 kWh for electricity consumption and generation respectively. The average size of household was around 5 to 6 persons (UN, 2017).

The electrification rate in Palestine is already 98% in 2017 (WBG, 2017), meaning that the infrastructure allows for different electricity uses in the residential sector, such as lighting, appliances (such as refrigerators, television, washing machines, etc.), as well as information and communication technologies (electronic equipment) and air conditioning.

As for air conditioners, their trend in the electricity consumption per household appears in Figure 64, which is assumed to follow the trend of electricity consumption in the residential sector. Although there was a slight increase in the electricity consumption between 2013 and 2015, the trend decreased towards 2016 apparently also due to the overall decrease in the electricity generation (limited supply). In 2017, the AC consumption increased one more time to reach the amount consumed in 2011.

Figure 64: Electricity Consumption for Air Conditioners (MWh) per Household in Palestine



The annual energy consumption or room air conditioners is expected to reach 2,900 GWh by 2030, in case the current pattern of consumption continues in Palestine. It is obvious that the potential of energy savings is high, if measures for energy efficiency are considered (U4E, 2018).

Palestine prepared a National Energy Efficiency Action Plan (NEEAP) to be implemented in 2 phases, the first from 2012 to 2015 and the second follows until 2020 by setting a target to reduce the electricity consumption by 5% by 2020 (base year 2012). It has also announced policies to promote solar water heaters, an attempt to reduce dependency on imported electricity and reduce the bill of unsubsidized energy prices (AFEX, 2017).

2.7.3. Relevant Insights for Assessing the Appliances

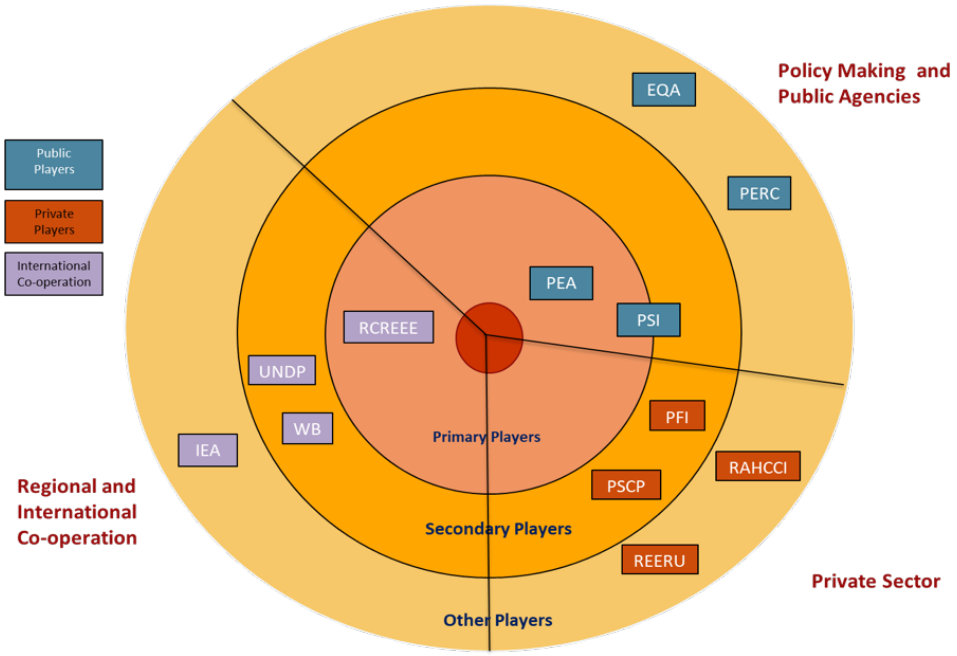
No clear evidence was found with regard to the existence and/or adoption of MEPS, standards and labels for different household appliances in Palestine, although there are some initiatives promoting energy efficiency measures for lighting (AFEX, 2017).

Table 7 below summarizes the status of MEPS, standards and labels for the common appliances in households which are currently under development (EU, 2018).

Table 7: Status of MEPS, Standards and Labels for Appliances in Palestine (EU, 2018)

	MEPS		S&L		
Appliances	Current Status	Regulation Type	Current Status	Regulation Type	Policy Type
Lighting	-	-	-	-	-
Refrigerators	-	-	-	-	-
Freezers	-	-	-	-	-
AC Units	-	-	-	-	-
Electric Water heater	-	-	-	-	-
Solar Water Heaters	-	-	-	-	-
Electric ovens for food	-	-	-	-	-
TV	-	-	-	-	-
Washing machines	-	-	-	-	-
Fans	-	-	-	-	-
Dishwashing machine	-	-	-	-	-

2.7.4. Key Stakeholders for Policy Design and Implementation



The chart above illustrates the key players and stakeholders in Palestine. It is mainly divided into three layers: the primary players include the public players as PEA, followed by PSI that falls between the primary and secondary players. Furthermore, the secondary players include part of the private sector, such as PSCP and PFI, as well as international co-operation agencies represented by WB and UNDP. The other stakeholders are mainly from private and public sectors.

2.8. Detailed Country Profile: Tunisia

2.8.1. Country Overview

Tunisia is considered as one of the Maghreb countries, which falls under the SEM region. It is considered as one of the most advanced countries when it comes to Energy Efficiency and Renewable Energies. Tunisia can also be considered one of the first movers in relation with the laws and regulations related to EE as well as the application of MEPS and Labels and standards. It is worth noting that Tunisia enjoys a combination of both an African and Mediterranean climate with generally high temperatures throughout the year with cooler weather at night.

2.8.2. Country's Analysis

In order to assess any country's economic situation at any time, that first indicator that we should be looking at is its Gross Domestic Product (GDP) evolution and growth rate over the years. Looking at Tunisia, we can see that its economy has been well progressing up until 2014, when it reached almost 48 billion dollars and then it started to fall in 2015, reaching only 40.26 billion dollars in 2017 which might be attributed in a way or another to the political situation. On the other hand, despite this sudden decrease in the GDP, the population kept rising from 2014 till 2017 with a steady growth rate causing the decrease of the GDP per capita. Figure 65 and Figure 66 below show in details the decrease in the GDP per capita, going from 4,270 dollars in 2014, reaching only 3,491 dollars in 2017 (World Bank, 2012-2017).

Figure 65: GDP and population growth in Tunisia (World Bank, 2012-2017)

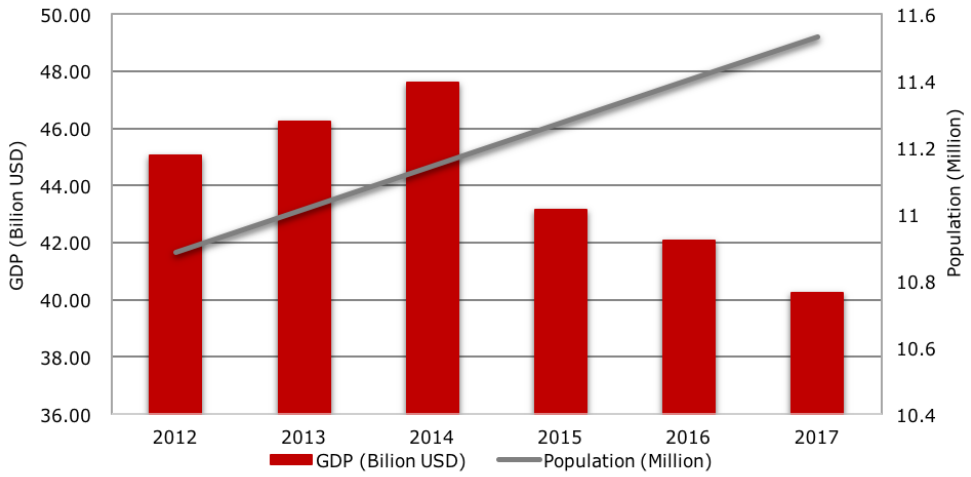
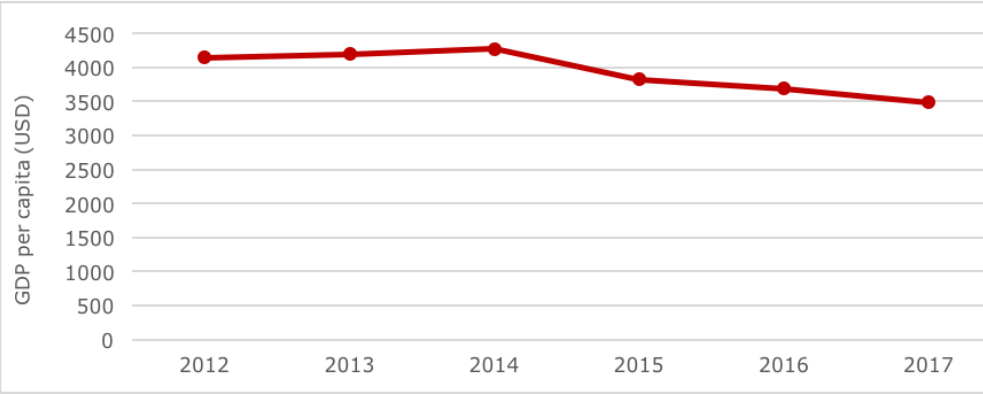
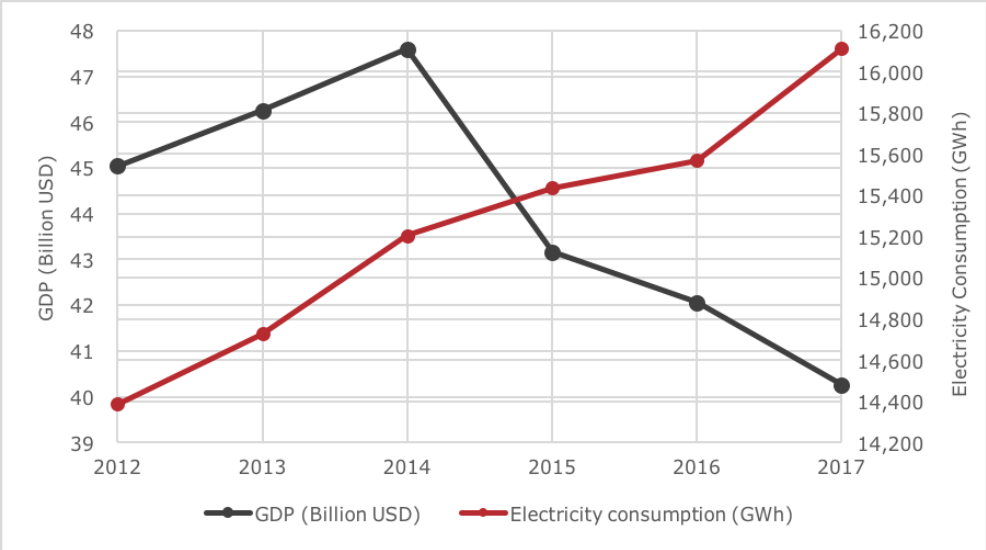


Figure 66: GDP per capita (USD) in Tunisia (World Bank, 2012-2017)



Not only did the population grew steadily, but also as we can see in Figure 67, the electricity use in the country was growing in the past years, moving from around 14,386 GWh in 2012 to reach almost 16113 GWh in 2017 (IEA, Statistics, 2012-2017). This electricity growth can be directly justified by the increase of population, which surpassed the economic development in the country in the period between 2014 and 2017 (World Bank, 2012-2017).

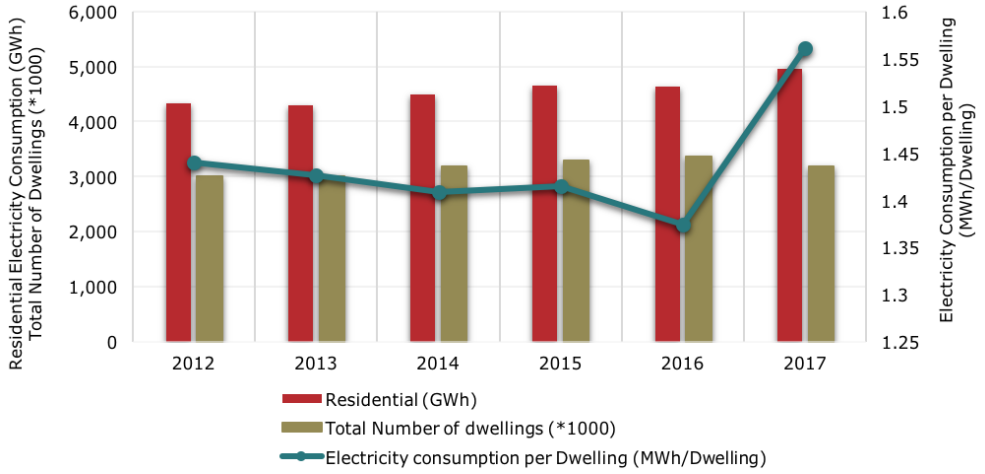
Figure 67: GDP vs. electricity use in Tunisia (IEA, Statistics, 2012-2017)



As a natural result of the population increase, the number of dwellings kept increasing in Tunisia, and if we look at the electricity consumption in the residential sector in the country, we can see that the share of each dwelling in

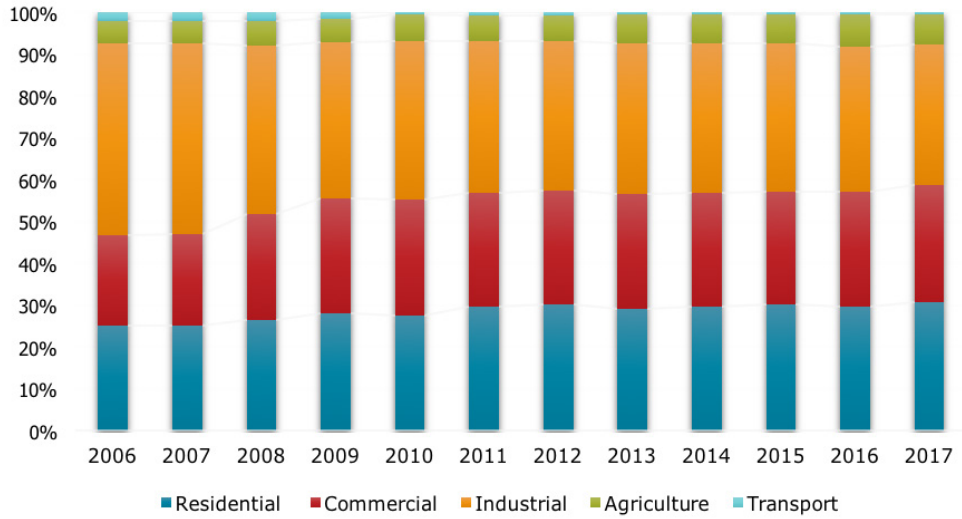
the electricity consumption moved from 1.44 MWh in 2012 to reach almost 1.37 MWh in 2016 (AUE, Statistical Bulletin, 2010-2016). In 2017, the electricity consumption per dwelling jumped from 1.37 to 1.56 MWh. This evolution, as illustrated in Figure 68, shows that the increase in the number of dwellings in the country even surpassed the increase in the electricity consumption in the residential sector causing the overall decrease of the electricity consumption per dwelling in the residential sector, which had an overall growth rate of -4.61% from 2012 till 2016 and a growth rate of 13.8% from 2016 to 2017. Nevertheless, with the steady increase in the electricity consumption in the sector, this can only mean that the consuption of home appliances has increased steadily since 2012 in Tunisia (AUE, Statistical Bulletin, 2010-2016 and IEA, Statistics, 2012-2017).

Figure 68: Electricity consumption per dwelling in Tunisia (AUE, Statistical Bulletin, 2012-2017)



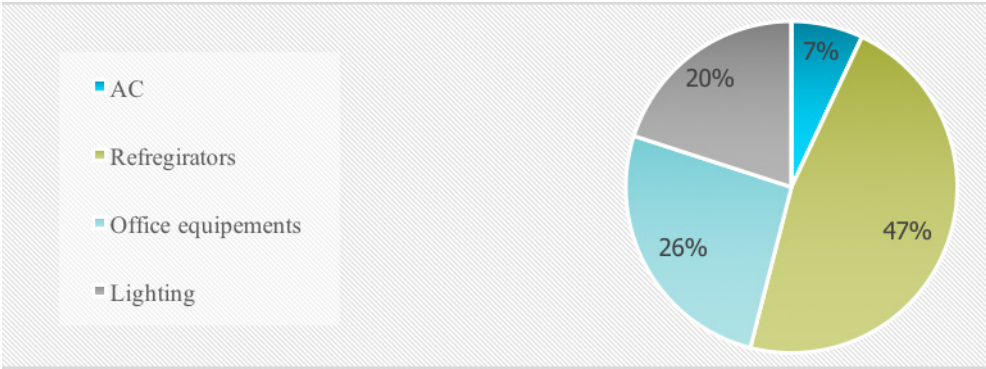
If we focus now on the electricity consumption distribution in the country, we can see that the industrial sector has been the first consumer since 2012, directly followed by the residential sector. This can be easily justified by the fact that the industrial sector is known to be an energy intensive sector worldwide. As per Figure 69, the residential sector on the other hand has kept an average of 27% of the total electricity consumption in the country reaching almost 33% of the total consumption of the electricity sector in 2017 (IEA, Statistics, 2012-2017).

Figure 69: Electricity consumption share per year in Tunisia (IEA, Statistics, 2006-2017)



Moving to the appliances share from the residential sector electricity consumption's, we can say that the appliances constitute almost 80% of the total consumption and the biggest share of this consumption goes to refrigerators with almost 47% as highlighted in Figure 70. This is followed by the office equipment constituting 26% and the lighting with almost 20% of the total consumption. The AC consumption in 2010 constituted almost 7% of the electricity consumption in the residential sector (RCREEE, 2012).

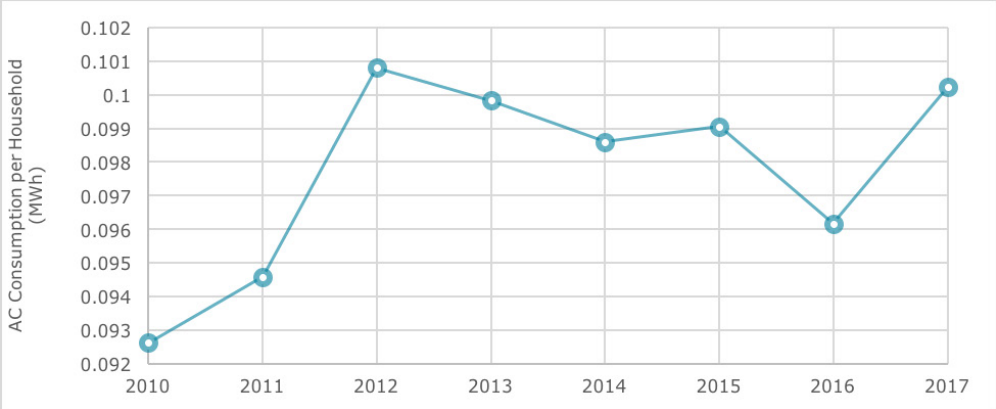
Figure 70: Appliances share from the total electricity consumption in the residential sector in Tunisia (RCREEE, 2012)



Over the years, the AC consumption in Tunisia have progressed reaching its maximum in 2012 with an average consumption of 0.187 MWh per household. As we can see in Figure 71, the consumption per household started

to decrease in 2013 and reached its lowest levels in 2017 being almost 0.17 MWh per household (AUE, Statistical Bulletin, 2012-2017). Nevertheless, it is worth noting that this decrease did not result mainly from the decrease in the number of ACs or the decrease of the AC consumption itself, but from the increase in the number of dwellings in the country thet surpassed the increase of the residential electricity consumption between 2010 and 2016, which had an overall growth rate of 24%. It is also worth noting that , in 2013, the AC sales constituted 12.1% of the sales in the Maghreb region (Morocco, Tunisia, Algeria and Libya) with a total of 806,000 units. These units are mainly belonging to class 3 (80%) as per the Tunisian standard, whilst class 1 only constituted 5% of the total (WBG, 2016).

Figure 71: AC consumption per household in Tunisia (RCREEE Calculations)



2.8.3. Relevant Insights for Assessing the Appliances

As for the appliances in the country, we have identified the list of appliances with MEPS and labels, along with their type, consumption and their current status as can be seen in Table 8 below.

Table 8: MEPS / Labels and standards and their status in Tunisia

	MEPS		S&L		
Appliances	Current Status	Regulation Type	Current Status	Regulation Type	Policy Type
Lighting	In place	Mandatory	Under development	Mandatory	Comparative
Refrigerators	In place	Mandatory	In place	Mandatory	Comparative
Freezers	In place	Mandatory	In place	Mandatory	Comparative
AC Units	In place	Mandatory	In place	Mandatory	Comparative
Electric Water heater	-	-	-	-	-
Solar Water Heaters	-	-	-	-	-
Electric ovens for food	-	-	-	-	-
TV	-	-	-	-	-
Washing machines	Under development	-	Under development	-	-
Fans	-	-	-	-	-
Dishwashing machine	-	-	-	-	-

The appliances labels and standards as well as the Minimum Energy Performance Standards (MEPS) in Tunisia have been well established since 2007, having several laws and by-laws mainly directed to increase the appliances' efficiency in the country.

Figure 72: MEPS timeline in Tunisia

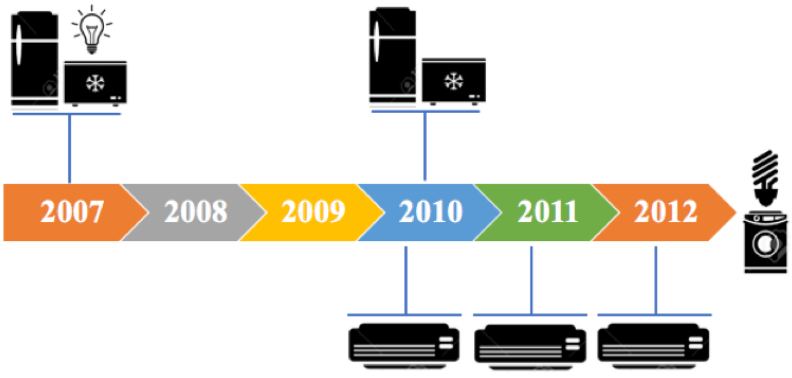
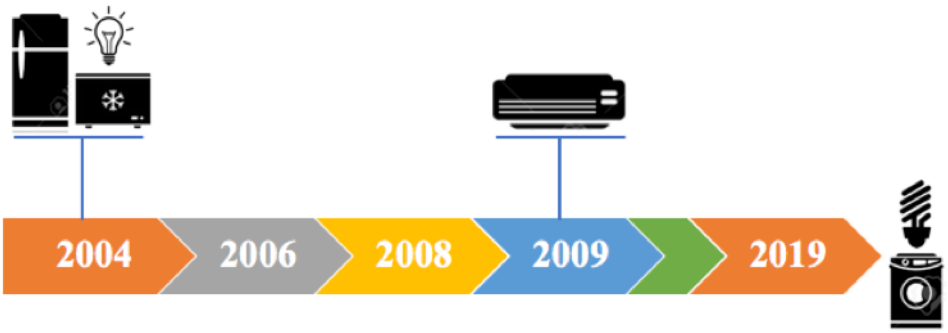
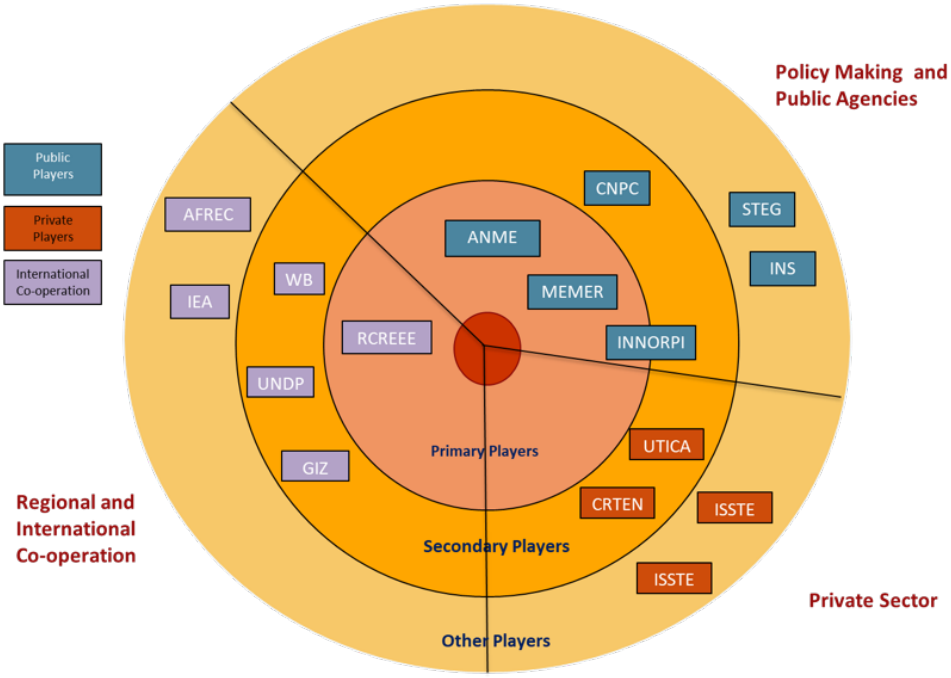


Figure 73: Labels and standards timeline in Tunisia



2.8.4. Key Stakeholders for Policy Design and Implementation

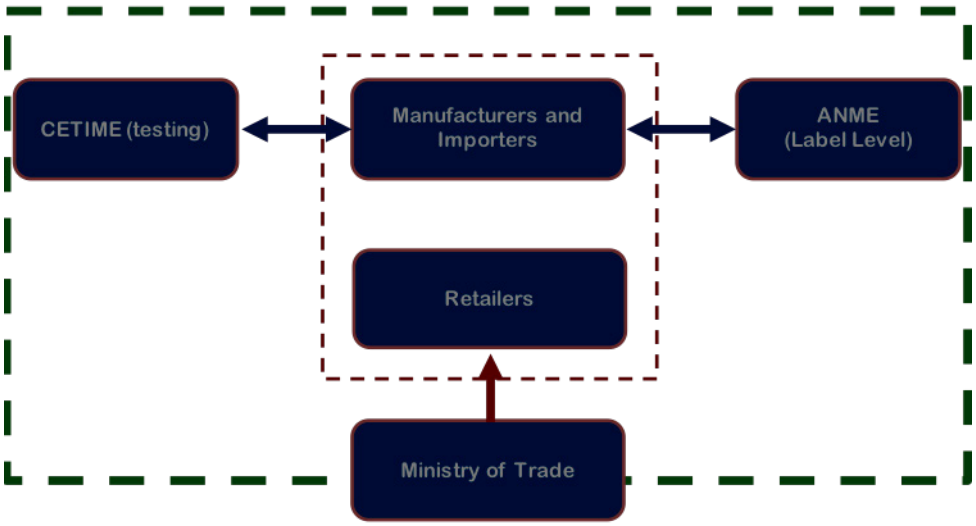


As previously described for the SEMCs, the chart illustrating the key players and stakeholders contains three layers of players: in the primary set, in Tunisia we find the MEMER and the ANME, in addition to INNORPI that could be considered as a primary and secondary player; the second level contains CRTEN and UTICA from the private sector as well as CNPC from the public sector. Regional and international co-operation organizations, such as WB, UNDP and

GIZ are also considered as secondary players; finally, there are other players frequently shared with the other SEMCs, such as the IEA and AFREC.

Responsible governmental bodies worked with local producers and importers prior to adopting the regulations to ensure that all the parties are fully aware of the requirements and have developed strategies to meet them. As illustrated in Figure 74, and according to the adopted implementation process of MEPS and Labeling in Tunisia, manufacturers and importers have to get first the certificate of compliance from CETIME by sending three samples of the equipment and then submit it to the ANME in order to issue the label. As for the accreditation of laboratories in the country, the Tunisian accreditation council (TUNAC) is responsible for providing accreditation for all the Tunisian testing laboratories. Furthermore, manufacturers and importers have six months as a grace period after the establishment of the label and preparation of required test labs in order to meet the regulation requirements.

Figure 74: Implementation process of MEPS and Labeling program in Tunisia



Part III:
Comparative SEMCs Analysis

This section covers the existing S&L and MEPS in all of the eight countries subject of the study, identifying and assessing the current energy efficiency (EE) policies, legal and regulatory framework providing a comparative analysis of all countries in order to measure their achieved development in the implementation of EE measures and to assess their readiness to join the proposed regional program for appliances.

3.1. Existing MEPS and L&S

Table 9: Existing MEPS and Labels in SEMCs

Country	Lighting		Refrigerators Freezers		Air Conditioners		Washing Machines		Dishwasher		Solar Water		TV		Electric Oven		Vacuum Cleaners		Electric heaters		Laundry Dryer		Fans	
Type	MEPS	Labels	MEPS	Labels	MEPS	Labels	MEPS	Labels	MEPS	Labels	MEPS	Labels	MEPS	Labels	MEPS	Labels	MEPS	Labels	MEPS	Labels	MEPS	Labels	MEPS	Labels
Algeria	●	●	●	●	●	●																		
Egypt	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			●	●
Jordan	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●			●	●		
Lebanon	●	●	●	●	●	●																		
Libya	●																							
Morocco		●	●	●	●	●					●													
Palestine																								
Tunisia	●	●	●	●	●	●	●	●			●													

●	Implemented
●	Planned

The analysis of the national and regional data shows that “Comparative Labelling” is predominant in the region. On the other hand, mandatory MEPS are the most used tools in the region. Records show that Libya is the only country in the region that did not nor plan to authorize any appliance label so far. No country in the region has adopted any labelling or MEPS for fans except for Egypt that has MEPS for fans under development. However, the reason why fans are included in this report -as a stand-alone appliance- is because some studies consider it as part of the cooling/air conditioning systems.

The top appliances with authorized MEPS and labels in the region are “AC”, “Refrigerators” and “Lightings” as they have official authorised MEPS and Label in six countries. “Solar Water Heaters” have MEPS in four countries. MEPS for “Washing Machines” are adopted in two countries and labelling is under development in one country. “TV” has MEPS and labels in two countries but it is considered in this report because it is an appliance that is found in almost every household.

3.2. National Energy Efficiency Action Plans (NEEAPs) and strategies

The SEMCs National Energy Efficiency Action Plans (NEEAPs) and energy targets are shown in table 10 below. It is realized that most of the SEMCs have updated NEEAPs, except for Algeria, Libya and Palestine. Similarly, all countries have announced energy targets except for Libya. Moreover, most of these countries have further identified the targets for the different sectors such as industrial, residential, commercial, etc. All countries have dedicated authorities and implementing agencies.

Table 10 : NEEAP and Energy Targets in SEMCs

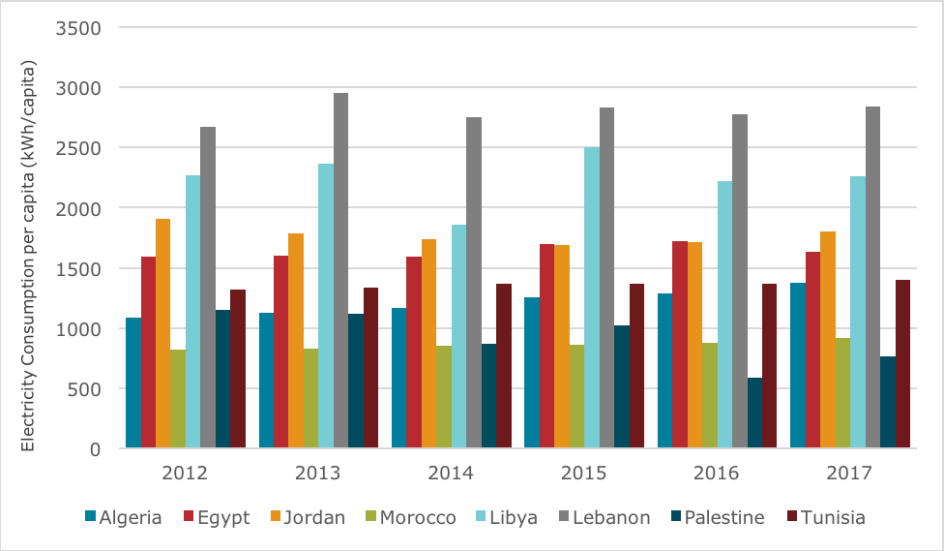
Country	Strategy	Target			Implementing Agency
		Sectors	Energy	%	
Algeria	NEEAP 2011-2013	200 Million Tons equivalent of CO2 / Gain of 7 Million TOE by 2030	—	—	APRUE
Egypt	NEEAP 2017-2020	National	20 Mtoe	18%	EE Unit of the Ministry of Electricity & Renewable Energy
		Buildings	8.6 Mtoe	16%	
		Industrial	6.8 Mtoe	18%	
		Transport	4.6 Mtoe	23%	
Jordan	NEEAP 2017-2020	National	1975 GWh	17,5%	NERC
		Residential	998 GWh	22,4%	
		Industrial	383 GWh	12,7%	
		Commercial	376 GWh	20,0%	
		Water Pumping	163 GWh	9,8%	
		Street Lighting	55 GWh	19,1%	
Lebanon	NEEAP 2016-2020	National	1975 GWh	17,5%	LCEC
		Residential	998 GWh	22,4%	
		Industrial	383 GWh	12,7%	
		Commercial	376 GWh	20,0%	
		Water Pumping	163 GWh	9,8%	
		Street Lighting	55 GWh	19,1%	
Libya	NEEAP 2014-2016				REAoL
Morocco	National Energy Efficiency Strategy 2030	National	—	25%	AMEE
		Residential	—	20%	
		Transport	—	35%	
		Industrial	—	2.5% reduction in energy intensity per year	
		Agriculture	—	0.2% reduction in energy intensity per year	
Palestine	NEEAP 2015-2017	National	137 GWh	—	PEA
		Residential & Tertiary	130 GWh	—	
		Industrial	6 GWh	—	
		Water Pumping	1 GWh	—	
Tunisia	New Energy Program 2013-2020	Building	8 Mtoe	49%	ANME
		Industrial	4.4 Mtoe	26%	
		Transport	4.1 Mtoe	25%	

3.3. Electricity Consumption in SEMCs

3.3.1. Electricity Consumption Trend

The average electricity consumption trend for each of the SEMCs is identified based on the total electricity consumption and population information; results are shown in figure 75 below. This analysis was done for a period of 6 years (2012-2017) to create a trend and show the electricity consumption pattern in the region. The results show that Libya, Jordan and Egypt are consistently the highest in electricity consumption per capita. However, no significant change/ reduction in the consumption pattern appears during the studied period except for Libya, which could be due to the turbulent political and economic situation in the country.

Figure 75: Total Electricity Consumption Trend (2012-2017)

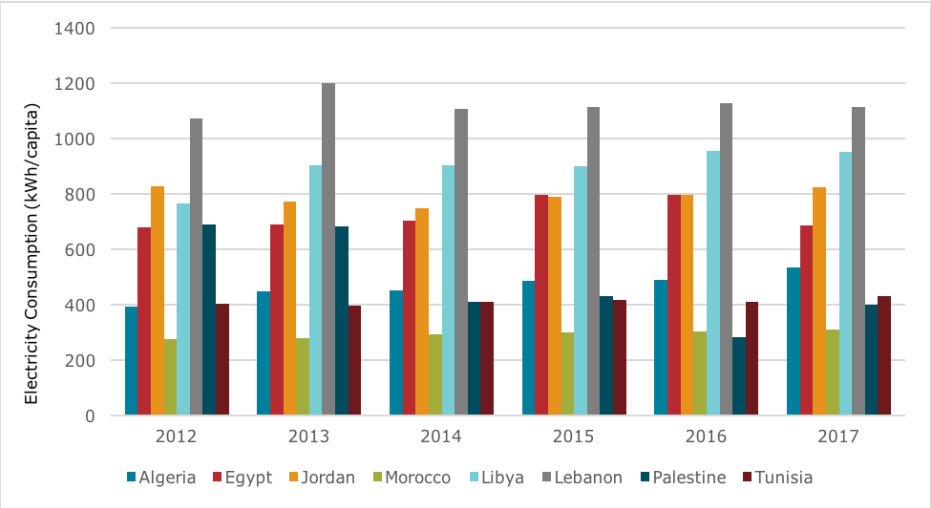


3.3.2. Electrical Energy Consumption in the Residential Sector

In order to get a better understanding of consumption patterns, the electricity consumption in the residential sector was planned for a period of 6 years (2012-2017) and is shown in figure 76 below. It is seen that consistently, in 2012 and 2013, Algeria, Morocco and Tunisia have the lowest records in residential electricity consumption in the region; then from 2014 till 2017, Pales-

tine took Algeria's place. The rest of the SEMCs have higher consumption and thus show higher potential for energy savings in the residential sector.

Figure 76: Electricity Consumption in the Residential Sector (2012-2017)

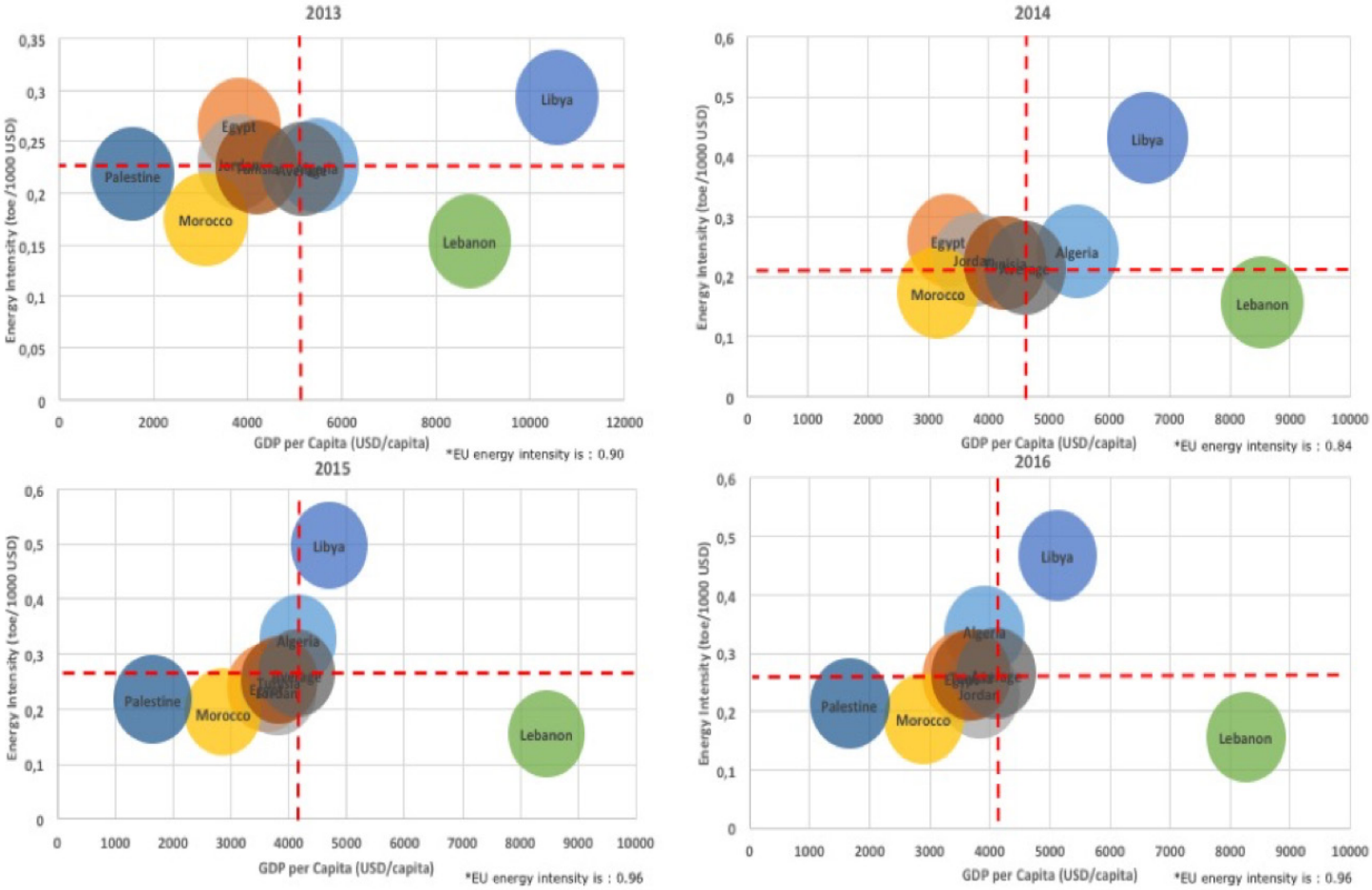


3.4. Energy Intensity

In this section, the energy intensity was calculated to serve as an indicator to assess the efficiency of the SEMCs economies and the decoupling between the energy consumption and the economic growth. Furthermore, the energy intensity was plotted against the GDP per Capita to show the relation between the energy efficiency and the standard of living in the SEMCs as shown in figure 77 below.

This analysis was done for the years 2013 – 2016 to ensure consistency of the obtained results and show the energy intensity trend for the SEMCs. Based on the obtained results and by studying the relative countries' positions in the graphs, the countries are relatively assessed for their EE achievements. For instance, Libya shows a higher energy intensity in comparison to the rest of the countries. Palestine, Morocco and Lebanon show a relatively lower energy intensity but also low GDP per capita ratio. However, these results and assessments remain only indicative as they also depend on other economic factors, such as the size of economy, trade and local industry. They are used in section 3.5 below as the bases for categorizing the countries into groups based on their energy efficiency performance.

Figure 77: Energy Intensity for SEMCs



3.5. Country Scoring and Categorization

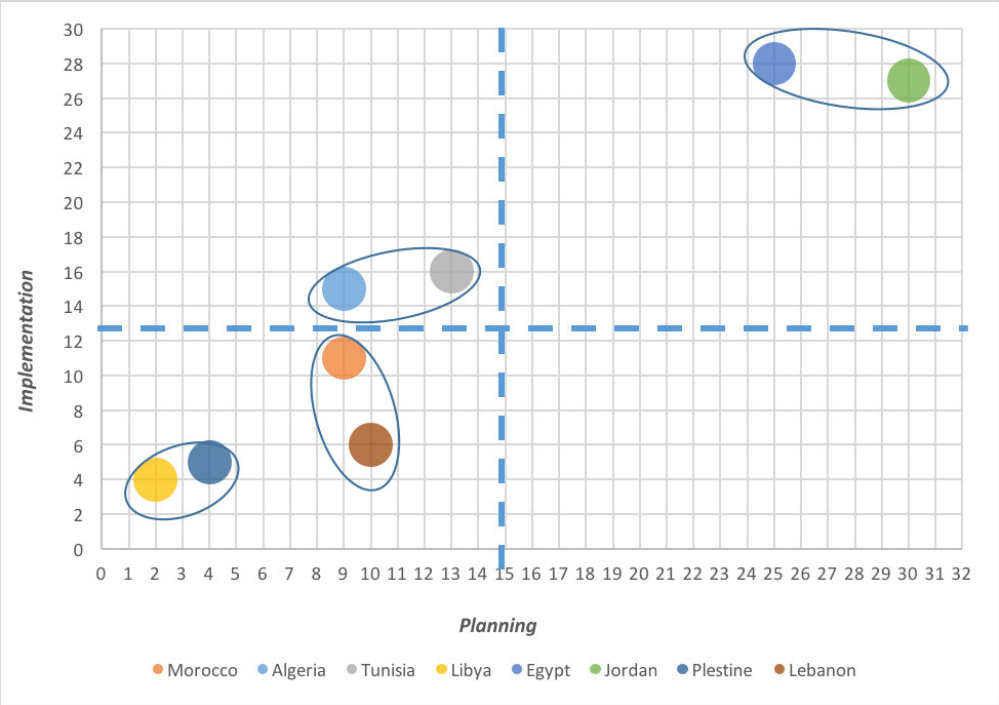
The previously-mentioned analysis factors were used to create a scoring system by which the countries were evaluated on their successful planning and implementation of EE measures as shown in table 11 below.

Table 11 : SEMCs Scoring for EE Planning and Implementation

Analysis Factors (Possible Score)		Morocco	Algeria	Tunisia	Libya	Egypt	Jordan	Palestine	Lebanon
Planning Factors (4)	NEEAP (1)	1	0	1	0	1	1	1	1
	Regulatory framework (1)	1	1	1	1	1	1	1	1
	Dedicated authority (1)	1	1	1	0	0	1	1	1
	EE Target (1)	1	1	1	1	1	1	1	1
	Planned Labels	3	3	4	0	11	10	0	3
	Planned MEPS	2	3	5	0	11	9	0	3
Implementation Factors (26)	Existing Labels (12)	1	3	2	0	11	9	0	0
	Existing MEPS (12)	0	3	4	0	11	8	0	0
	MVE (1)	0	1	1	0	1	1	0	0
	National manufacturing (1)	1	1	1	0	1	1	1	1
	Existing Labs (1)	1	1	1	0	1	1	0	1
	Rang of stakeholders (8)	7	6	6	4	7	7	4	4
	Availability of ESCOs (1)	1	0	1	0	1	1	0	0

The obtained scores show that the top achievers in the region are Egypt and Jordan; whereas Palestine and Libya scored the least. Furthermore, in order to obtain a clear categorization of the SEM countries, the analysis factors (planning and implementation factors) were used to plot figure 78 that shows the relative countries' positions based on their obtained scores.

Figure 78: SEMCs Categorization



Through analyzing the figure above, the SEMCs can be divided into 4 categories as follows:

Category I	Countries of **Advanced Progress** in the adaptation of EE measures *(Egypt and Jordan)*
Category II	Countries of **Medium Progress** in the adaptation of EE measures *(Tunisia and Algeria)*
Category III	Countries of **Increased Progress** in the adaptation of EE measures *(Lebanon and Morocco)*
Category IV	Countries of **Minimum Progress** in the adaptation of EE measures *(Libya and Palestine)*

Based on this analysis, Tunisia falls between Category I and II, while Morocco falls between Category II and III and further analysis is needed to place the country in any of these categories.

Figure 79: Planning & Implementation of EE Measures in SEMCs

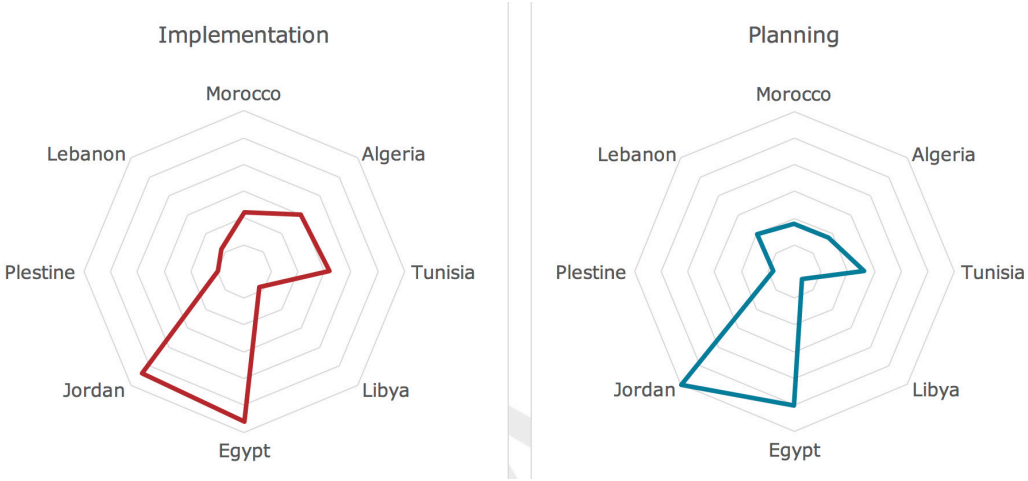


Figure 79 above shows the countries progress in the Planning as well as the Implementation of EE measures in SEMCs based on the chosen analysis factors in Table 11. Some countries excel in both planning and implementation such as Egypt and Jordan while others, such as Morocco, excel at Planning and lags a little bit behind when it comes to Implementation.

3.6. SEMCs Trend analysis

A trend analysis was made for the years 2003 – 2018 in order to record the time line for implementation of the MEPS and labels in the SEMCs and the results are shown in Figure 80 and Figure 81 below.

Figure 80 : Trend of MEPS in SEMCs

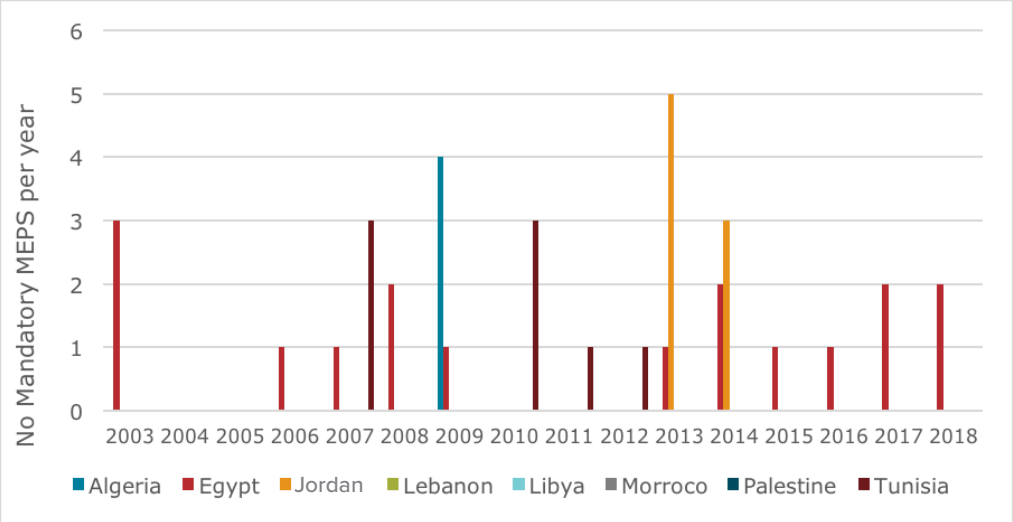
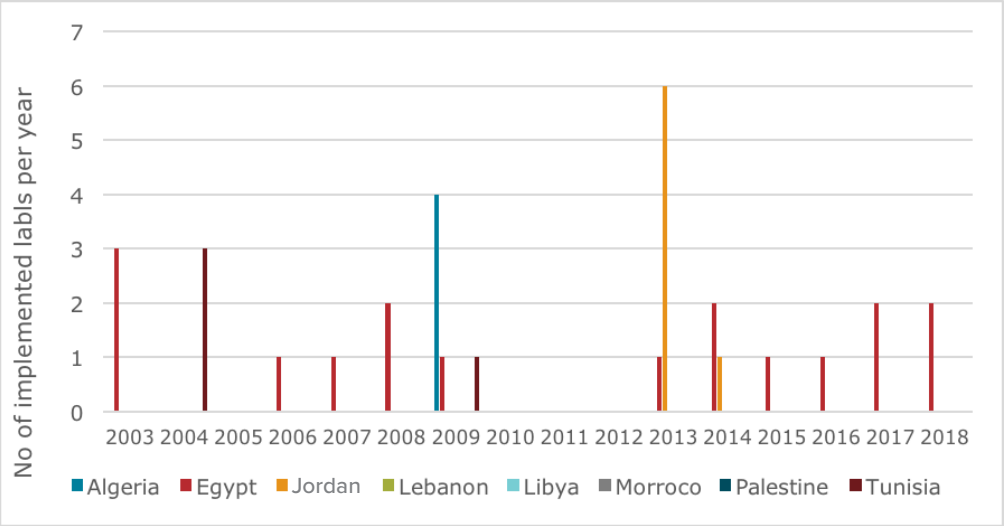


Figure 81 : Trend of Appliances' Labels in SEMCs



The figures above show that the first country in the region to start implementing MEPS and labels was Egypt in 2003, followed by Tunisia in 2004. Egypt holds the highest record for implemented MEPS (11) and labels (11) for appliances in the region. The years 2013 and 2014 were good years for EE measures for appliances in the region when MEPS and labels were authorized or updated for 11 appliances in different countries.

Part IV:
Recommendations and Conclusions

The following recommendations are important for the success of the deployment of energy efficient measures at the national level:

- The development of relevant policies and regulations (i.e. incentives and reduced taxation on efficient appliances) in order to facilitate the acceleration of adaptation of MEPS and labelling for appliances.
- The review and update of energy efficiency regulations to ensure availing the funding, capacity and resources needed for deploying MEPS and labels.
- The encouragement of technical research that explores different technology options in adopting EE appliances, such as solar air conditioning.
- The development of energy databases to facilitate the processing of household appliances' data and the encouragement of issuing periodic studies showing the right pathways to improve energy consumption patterns in the country.
- The provision of testing facilities and labs to facilitate the required testing and verification of appliances' compliance with the MEPS and issued regulations.
- Capacity building and awareness-raising campaigns for policy makers as well as communities on the importance of the use of energy efficient appliances that would serve both climate change and energy security purposes.
- The establishment of monitoring and surveillance processes/programs for appliances at the national level in order to ensure the successful implementation on the MEPS and labels program.
- The creation of a regional technical platform to exchange knowledge and successful experiences as well as to provide the support and technical know-how for countries in the development of national MEPS and labeling programs.

5.

References

- AFEX. (2017). *Arab Future Energy Index, Energy Efficiency.* Cairo: The Regional Center for Renewable Energy and Energy Efficiency.
- AFREC. (2018). Statistics on residential energy consumption data collection. AFREC.
- Atkins. (2012). Guidelines for MEPS & Labels at the continental level., (p. 18).
- (2006-2017). *AUE.*
- (2010-2016). *AUE.*
- AUE. (2010-2016). *Statistical Bulletin.* Retrieved December 21, 2018, from http://auptde.org/Publications.aspx?lang=en&CID=36
- (2010-2017). *AUE.*
- AUE. (2010-2017). *Statistical Bulletin.* Retrieved December 21, 2018, from http://auptde.org/Publications.aspx?lang=en&CID=36
- AUE. (2012&2016). *Statistical Bulletin.* Retrieved December 22, 2018, from http://auptde.org/Publications.aspx?lang=en&CID=36
- AUE. (2012&2017). *Statistical Bulletin.* Retrieved December 22, 2018, from http://auptde.org/Publications.aspx?lang=en&CID=36
- (2012-2017). *AUE.*
- AUE. (2012-2017). *Statistical Bulletin.* Retrieved December 20, 2019, from http://auptde.org/Default.aspx?lang=en
- AUE. (2012-2017). *Statistical Bulletin.* Retrieved December 20, 2019, from http://auptde.org/Default.aspx?lang=en
- AUE. (2017). *Arab Union for Electricity, Annual Statistical Bulletin.* Amman, Jordon : Arab Union for Electricity.
- CIA. (2018, December). *The World Factbook, Libya: Economic Overview* . Retrieved from Central Intelligence Agency: https://www.cia.gov/library/publications/the-world-factbook/geos/ly.html
- CIA. (2018, December). *The World Factbook, West Bank: Economic Overview.* Retrieved from Central Intelligence Agency: https://www.cia.gov/library/publications/the-world-factbook/geos/we.html
- CLASP. (2018). *Polict Database.* Retrieved from https://clasp.ngo/policies
- (2018). *CLASP Database.*
- (2018). *EU.*
- *euromonitor.* (2018).
- IEA. (2010-2016). *Statistics.* Retrieved December 22, 2018, from https://www.iea.org/statistics/?country=LEBANON&year=2012&category=Key%20indicators&indicator=TPESbySource&mode=chart&categoryBrowse=false&dataTable=BALANCES&showDataTable=true
- IEA. (2010-2017). *Statistics.* Retrieved December 22, 2018, from https://www.iea.org/statistics/?country=LEBANON&year=2012&category=Key%20indicators&indicator=TPESbySource&mode=chart&categoryBrowse=false&dataTable=BALANCES&showDataTable=true

- IEA. (2010-2017). *Statistics*. Retrieved from https://www.iea.org/statistics/?country=JORDAN&year=2016&category=Electricity&indicator=TPESbySource&mode=chart&categoryBrowse=true&dataTable=ELECTRICITYANDHEAT&showDataTable=true
- IEA. (2012&2016). *Statistics.* Retrieved December 22, 2018, from https://www.iea.org/statistics/?country=LEBANON&year=2012&category=Key%20indicators&indicator=TPESbySource&mode=chart&categoryBrowse=false&dataTable=BALANCES&showDataTable=true
- IEA. (2012&2017). *Statistics.* Retrieved December 22, 2018, from https://www.iea.org/statistics/?country=LEBANON&year=2012&category=Key%20indicators&indicator=TPESbySource&mode=chart&categoryBrowse=false&dataTable=BALANCES&showDataTable=true
- (2012-2017). *IEA.*
- (2012-2017). *IEA.*
- IEA. (2012-2017). *Statistics.* Retrieved from https://www.iea.org/statistics/?country=LEBANON&year=2016&category=Key%20indicators&indicator=TPESbySource&mode=chart&categoryBrowse=false&dataTable=BALANCES&showDataTable=true
- IEA. (2012-2017). *Statistics.* Retrieved from https://www.iea.org/statistics/?country=JORDAN&year=2016&category=Electricity&indicator=TPESbySource&mode=chart&categoryBrowse=true&dataTable=ELECTRICITYANDHEAT&showDataTable=true
- IEA. (2012-2017). *Statistics.* Retrieved from https://www.iea.org/statistics/?country=LEBANON&year=2016&category=Key%20indicators&indicator=TPESbySource&mode=chart&categoryBrowse=false&dataTable=BALANCES&showDataTable=true
- IEA. (2012-2017). *Statistics.* Retrieved from https://www.iea.org/statistics/?country=LEBANON&year=2016&category=Key%20indicators&indicator=TPESbySource&mode=chart&categoryBrowse=false&dataTable=BALANCES&showDataTable=true
- IEA. (2012-2017). *Statistics.* Retrieved from https://www.iea.org/statistics/?country=JORDAN&year=2016&category=Electricity&indicator=TPESbySource&mode=chart&categoryBrowse=true&dataTable=ELECTRICITYANDHEAT&showDataTable=true
- IEA. (2012-2017). *Statistics.* Retrieved from https://www.iea.org/statistics/?country=LEBANON&year=2016&category=Key%20indicators&indicator=TPESbySource&mode=chart&categoryBrowse=false&dataTable=BALANCES&showDataTable=true
- IEA. (2017). *Libya: Electricity and heat for 2016.* Retrieved from International Energy Agency: https://www.iea.org/statistics/?country=LIBYA&year=2016&category=Key%20indicators&indicator=ElecConsPerCapita&mode=chart&categoryBrowse=true&dataTable=ELECTRICITYANDHEAT&showDataTable=true
- IEA. (2017). *Libya: Electricity and heat for 2016.* Retrieved from International Energy Agency: https://www.iea.org/statistics/?country=LIBYA&year=2016&category=Key%20indicators&indicator=ElecConsPerCapita&mode=chart&categoryBrowse=true&dataTable=ELECTRICITYANDHEAT&showDataTable=true
- IEA. (2017). *Morocco: Electricity and heat for 2016.* Retrieved from International Energy

Agency: https://www.iea.org/statistics/?country=MOROCCO&year=2016&category=Key%20indicators&indicator=TPESbySource&mode=chart&categoryBrowse=false&dataTable=ELECTRICITYANDHEAT&showDataTable=true

- IEA. (2017). *Morocco: Electricity and heat for 2016.* Retrieved from International Energy Agency: https://www.iea.org/statistics/?country=MOROCCO&year=2016&category=Key%20indicators&indicator=TPESbySource&mode=chart&categoryBrowse=false&dataTable=ELECTRICITYANDHEAT&showDataTable=true
- IEA. (2018). *Egypt.*
- IEA. (2018, 2018 November). *Morocco.* Retrieved from International Energy Agency: https://www.iea.org/countries/Morocco/
- IEA. (2018). *Statistics.* Retrieved December 22, 2018, from https://www.iea.org/statistics/?country=JORDAN&year=2016&category=Key%20indicators&indicator=TPESbySource&mode=chart&categoryBrowse=false&dataTable=ELECTRICITYANDHEAT&showDataTable=true
- Khaled Bataineh, & Ayham Alrabee. (2018). *Improving the Energy Efficiency of the Residential. MDPI.* Retrieved from www.mdpi.com/2075-5309/8/7/85/pdf
- LAS. (2017). *Guide for Renewable Energy and Energy Efficiency in the Arab Countries (Daleel).* Cairo: Regional Center for Renewable Energy and Energy Efficiency.
- LCEC. (2016). *NATIONAL ENERGY EFFICIENCY ACTION PLAN FOR THE REPUBLIC OF LEBANON. LCEC.* Retrieved December 2018, 2018, from http://climatechange.moe.gov.lb/viewfile.aspx?id=229
- MEDENER. (2013). *Energy Efficiency Trends in Mediterranean Countries. The Mediterranean Association of National Agencies for Energy Conservation (MEDENER).* The MENENER Network on Energy Efficiency Indicators in Southern and Eastern Mediterranean Countries.
- Ms. Florentine Visser, & Mr. Marcello Antinucci. (2018). *EU Technical Assistance Facility for Sustainable Energy.*
- Najwa Yaacoub, & Lara Badre. (2012). *Population & Housing in Lebanon.* https://civilsociety-centre.org/sites/default/files/resources/CAS_Population_and_housing_In_Lebanon_SIF2.pdf: Central Administration of Statistics. Retrieved November 26, 2018, from http://www.cas.gov.lb/images/PDFs/SIF/CAS_Population_and_housing_In_Lebanon_SIF2.pdf
- Nsour, F. F. (2015). *National Household Load Survey Report 2015.* Retrieved December 20, 2018, from https://escb-jordan.org/wp-content/uploads/2016/05/National-Load-Survey-Report-FINAL-DRAFT1-Dec-14.pdf
- RCREEE. (2012). *National programs for residential appliances energy efficiency in RCREEE Member States.* Retrieved December 22, 2018, from http://www.rcreee.org/sites/default/files/modelsguides_standardsforhomeappliancesinrcreeemembersates_12_ar.pdf
- RCREEE. (2012). *National Programs for the Efficiency of Households' Electric Appliances.* Cairo: GEF UNDP - Energy Efficiency Lighting and Appliances.

- RCREEE. (2017). *Arab Future Energy Index.* Retrieved December 22, 2017, from http://rcreee.org/content/arab-future-energy-index-afex-2017-energy-efficiency
- RISE. (2016). Retrieved from Regulatory Indicators for Sustainable Energy: http://rise.esmap.org/country/morocco
- RISE. (2018, December). *Morocco.* Retrieved from Regulatory Indicators for Sustainable Energy: http://rise.esmap.org/country/morocco
- U4E. (2018, December). *Libya Savings Policies Assessment.* Retrieved from United for Efficiency: https://united4efficiency.org/country-assessments/libya/
- U4E. (2018, December). *Morocco Savings Policies Assessment.* Retrieved from United for Efficiency: https://united4efficiency.org/country-assessments/morocco/
- U4E. (2018, December). *State of Palestine Savings Policies Assessment.* Retrieved from United for Efficiency: https://united4efficiency.org/country-assessments/state-of-palestine/
- UN. (2017). *Household Size and Composition Around the World.* United Nations, Economic and Social Affairs. United Nations Database. Retrieved December 2018, from http://www.un.org/en/development/desa/population/publications/pdf/ageing/household_size_and_composition_around_the_world_2017_data_booklet.pdf
- WBG. (2016). *Access to electricity (% of population).* Retrieved from The World Bank: https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS
- WBG. (2016). *Energy-Efficient Air Conditioning: A Case Study of the Maghreb - Opportunities for a more efficient market.* Washington: International Bank for Reconstruction and Development / The World Bank Group.
- WBG. (2017). *Energy-Efficient Air Conditioning: A Case Study of the Maghreb - Opportunities for a more efficient market.* Washington: International Bank for Reconstruction and Development / The World Bank Group.
- WBG. (2017). *Libya.* Retrieved from The World Bank Group: https://data.worldbank.org/country/libya
- WBG. (2017). *Morocco.* Retrieved December 2, 2018, from The World Bank Group: https://data.worldbank.org/country/morocco
- WBG. (2018, December). *Libya.* Retrieved from The World Bank: http://www.worldbank.org/en/country/libya/overview#1
- World Bank. (2012-2016). Retrieved from https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=JO&view=chart & https://data.worldbank.org/indicator/SP.POP.TOTL?locations=JO
- World Bank. (2012-2016). Retrieved from https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=JO&view=chart & https://data.worldbank.org/indicator/SP.POP.TOTL?locations=JO
- World Bank. (2012-2016). Retrieved from https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=LB

- World Bank. (2012-2017). Retrieved from https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=LB
- World Bank. (2012-2017). *World Bank Open Data.* Retrieved from https://data.worldbank.org/
- World Bank. (2012-2017). *World Bank Open Data.* Retrieved from https://data.worldbank.org/
- World Bank. (2017). Retrieved 11 25, 2018, from https://data.worldbank.org/indicator/SP.POP.TOTL?locations=LB & https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=LB
- Worldmeters. (2012-2017). World meters. Retrieved from https://www.worldometers.info/gdp/state-of-palestine-gdp/
- Worldometers. (2018). *Worldometers.* Retrieved November 25, 2018, from Lebanon Population: http://www.worldometers.info/world-population/lebanon-population/

This publication is a product of the meetMED (Mitigation Enabling Energy Transition in the Mediterranean region) project which is funded by the European Union and jointly implemented by the Mediterranean Association of the National Agencies for Energy Management (MEDENER) and the Regional Centre for Renewable Energy and Energy Efficiency (RCREEE). The conclusions of this report result from the analysis of the Country Policy Papers prepared by the meetMED Regional Expert Network (REN) – a network composed by experts coming from 13 Mediterranean countries – the aim of which is to support national governments in the implementation of EE and RE policies enhancing national programmes and frameworks in the region. Since 2012, the eight target countries (Algeria, Egypt, Jordan, Lebanon, Libya, Morocco, Palestine and Tunisia) have improved their energy efficiency and renewable energy sectors, having put in place long-term national energy strategies that set ambitious targets for energy savings and renewable energy penetration. Nevertheless, several challenges still hinder the development of EE and RE, particularly related to governmental, technical or information aspects. This report identifies a set of recommendations that can be implemented to promote the development of both sectors. Awareness of the population for EE and RE benefits should be one of the main objectives of the countries since the lack of knowledge is a clear barrier to the dissemination of good practices. Regional cooperation should be encouraged to facilitate the energy transition in the Southern and Eastern Mediterranean Countries (SEMCs) – cooperation will accelerate the implementation of common measures and help overcome shared barriers.

meetMED

www.meetmed.org

info@meetmed.org @meetmed1

meetMED Secretariat - c/o MEDENER
Rue de Namur 72, 1000 Bruxelles