J R E E E F
Jordan Renewable Energy & Energy Efficiency Fund
صندوق تشجيع الطاقة المتجددة وترشيد الطاقة
MINISTRY OF ENERGY AND MINERAL RESOURCES
وزارة الطاقة والثروة المعدنية

وزارة الطاقة والثروة المعدنية
المملكة الأردنية الهاشمية

The Second National Energy Efficiency Action Plan (NEEAP) for the Hashemite Kingdom of Jordan

2017-2020

March 2017

Table of content

Introduction

Part 1: Current energy situation

1 ENERGY DEPENDENCY IN JORDAN 9

2 ENERGY DEMAND 9

3 ENERGY PERFORMANCE ASSESSMENT 10

4 EVALUATION OF THE FIRST NEEAP 2012-2014 11

1 FUTURE SCENARIOS DESCRIPTION AND MAIN ASSUMPTIONS 17

1.1 MAIN ASSUMPTIONS 17
1.2 SCENARIOS DEFINITION 18
1.2.1 The Business as Usual Scenario (BaUS) 18
1.2.2 Energy Efficiency Scenario (EES) 18

2 ENERGY DEMAND 18

2.1 GLOBAL TRENDS 18
2.2 SECTORS' DEMAND 19

3 MAIN IMPACTS OF THE EES 21

3.1 ENERGY SAVING 21
3.2 ENERGY PERFORMANCES 21
3.3 ENERGY BILL SAVING 22
3.4 CO2 EMISSIONS REDUCTION 22

1 OVERVIEW: OVERALL NATIONAL INDICATIVE TARGET 24

1.1 KEY INDICATORS 24
1.2 SUMMARY OF THE RESULTS OF THE NEW NEEAP 24
1.2.1 Calculation methodology of NEEAP electricity savings target for 2020 24
1.2.2 Indicative target of the second NEEAP (2017-2020) 25
1.2.3 Main impacts of the NEEAP 25

2 PLANNED AND ONGOING EE MEASURES AT SECTOR'S LEVEL 26

2.1 RESIDENTIAL SECTOR (4 MEASURES) 26
2.1.1 MEASURE 1: Replacement of incandescent lamps with LED lamps in Residential Sector 27
2.1.2 MEASURE 2: Energy Label and Standard program for home appliances 29
2.1.3 MEASURE 3: Energy Efficiency building code enforcement in residential sector 31
2.1.4 MEASURE 4: Roof insulation of existing buildings in residential sector 32
2.2 COMMERCIAL AND SERVICES SECTOR (6 MEASURES) 34
2.2.1 MEASURE 5: Jordan public building energy efficiency program 35
2.2.2 MEASURE 6: Replacement of Fluorescent Tubes in public buildings 35
2.2.3 MEASURE 7: Energy efficiency in existing health centers 36
2.2.4 MEASURE 8: Replacement of Fluorescent Tubes in commercial buildings by LEDs 37
2.2.5 MEASURE 9: Energy efficiency in existing small and medium hotels 38
2.2.6 MEASURE 10: Energy Efficiency building code enforcement in tertiary sector 39
2.3 MEASURE 11: INDUSTRIAL SECTOR (ONE MEASURE) 40
2.4 WATER PUMPING SECTOR (11 MEASURES) 42
2.4.1 MEASURE 12: EE program at Wala-Libb pump operations outsourcing 43
2.4.2 MEASURE 13: EE program for cost savings: WWTP Wadi Shalala 44
2.4.3 MEASURE 14: Energy Efficiency Program I 45
2.4.4 MEASURE 15 : EE program at WWTP Irbid Central and Wadi Arab Digesters 46
2.4.5 MEASURE 16 : Energy Efficiency program II 47
2.4.6 MEASURE 17 : EE program for cost savings: Introduction of regular energy audits 48

2.4.7 MEASURE 18: Aqeb Conveyor Project/ Gravity Supply Mafraq from upper Aqeb 49
2.4.8 MEASURE 19: EE program for cost savings at Baqorieh pumping station 50
2.4.9 MEASURE 20: EE program at Zarqa Governorate pumping stations 51
2.4.10 MEASURE 21: Replacement of 25 pumps for Zara Ma'en pumping stations 52
2.4.11 MEASURE 22: EE program for cost savings at Zai pumping station 53
2.5 MEASURE 23: STREET LIGHTING (ONE MEASURE) 54
2.6 MUNICIPAL LEVEL 55
2.6.1 MEASURE 24: Energy Efficiency in the Al-KARAK Municipality Buildings building 56
2.6.2 MEASURE 25: Reduce the consumption of street lighting for Al-Karak Municipality 57
2.7 MEASURE 26: TRANSPORT SECTOR 57

3 CROSS-SECTORIAL MEASURES (8 MEASURES) 59

3.1 MEASURE 27: RE&EE EQUIPMENT EXEMPTION FROM CUSTOM DUTIES & SALE TAXES 59
3.2 MEASURE 28: THE JORDAN RENEWABLE ENERGY&ENERGY EFFICIENCY FUNDS (JREEEF) 60
3.3 MEASURE 29: ENERGY EFFICIENCY BUILDINGS CODES 62
3.4 MEASURE 30 : RENEWABLE ENERGY AND ENERGY EFFICIENCY EU PROGRAM (REEE II) 63
3.5 MEASURE 31: MINARET PROJECT 64
3.6 MEASURE 32: CES-MED PROJECT 65
3.7 MEASURE 33: SUDEP / SAHAB PROJECT 67
3.8 MEASURE 34: NATIONAL GREEN GROWTH PLAN (GGGI JORDAN) 68

4 CRITERIA TO ASSESS ENERGY EFFICIENCY POLICY IMPLEMENTATION PROGRESS 69

MAIN REFERENCES 71

ANNEXES 72
ANNEX 1: EXAMPLE OF ASSUMPTIONS OF EES IN RESIDENTIAL AND TERTIARY SECTORS 72
ANNEX 2: CALCULATION OF THE MEASURES IMPACTS OF THE NEEAP 76

Table of illustrations

Figure 1: Final and primary energy consumption 9
Figure 2: Electricity consumption & GDP growth....9
Figure 3: Electricity consumption structure 10
Figure 4 : Primary and final energy intensities....10
Figure 5 : Primary energy intensity of selected countries....10
Figure 6 : Electricity intensity 11
Figure 7 : Specific consumption of electricity generation....11
Figure 8 : Forecasted final energy demand....19
Figure 9 : Forecasted electricity demand....19
Figure 10: Forecasted primary energy demand 19
Figure 11 : Final energy consumption structure by 2030 compared to 2014....20
Figure 12 : Electricity consumption structure by 2030 compared to 2014....20
Figure 13 : Electricity demand by sector according to BaUS and EES in 2020 21
Figure 14 : Electricity demand by sector according to BaUS and EES in 2030 21
Figure 15 : GDP and final energy demand according to BaUS and EES (2015=100) 22
Figure 16 : GDP and electricity demand according to BaUS and EES (2015=100) 22
Figure 17 : Forecasted final energy intensity 22
Figure 18 : Forecasted electricity intensity 22
Figure 19: Yearly energy bill saving for Jordan....22
Figure 20 : Forecasted CO2 emissions by scenario 23
Figure 21 : Forecasted carbon intensity by scenario....23
Figure 22: Forecasted emission factor of electricity sector 23

Table 1: Indicative Target for the First NEEAP 11
Table 2: Main macroeconomic and demographic assumptions 18
Table 3: Final Energy consumption per sector according to BaUS and EES (ktoe) 20
Table 4: Accumulated energy saving according to EES compared to BaUS (ktoe) 21
Table 5: Key energy indicators for Jordan....24
Table 6: Indicative Target for the Updated NEEAP 25
Table 7: Main NEEAP impacts indicators....25
Table 8: Summary of EE measures in residential sector 26
Table 9: Summary of EE measures in commercial and Services sector 34
Table 10: Summary of EE measures in industrial sector 40
Table 11: Summary of EE measures in water pumping sector....42
Table 12: Summary of EE measures in street lighting....54
Table 13: Summary of main cross-cutting measures 59
Table 14: Synthesis of JREEEF action plan up to 2020 (source: JREEEF) 61
Table 15: Main progress indicators for NEEAP monitoring and Evaluation....69

List of Acronyms

AFD	French Agency of Development
CB	Capital Bank
DFZC	Development and Free Zones Commission
EDCO	Electricity Distribution Company
EE	Energy Efficiency
EEO	Energy Efficiency Office
EE S&L	Energy Efficiency Standards & Labeling
EPC	Energy performance Contracting
ERC	Electricity Regulatory Commission
ESCO	Energy Services Companies
EU	European Union
GAM	Greater Amman Municipality
GEF	Global Environment Facility
GHG	Green House Gases
IDECO	Irbid District Electricity Company
IEE	Improvement of Energy Efficiency Project
IPP	Independent power producers
JD	Jordan Dinars (1 US$ = 0.7 JD)
JDZ	Jordan Company for Development Zones
JEDCO	Jordan Enterprise Development Corporation
JEPCO	Jordan Electric Power Company
JES	Jordan Environment Society
JOD	Jordan Dinar
JREEEF	Jordan Renewable Energy and Energy Efficiency Fund
JSMO	Jordan standards & Metrology Organization
LAS	League of Arab States
MEMR	Ministry of Energy and Mineral Resources
MED-EMIP	Euro- Mediterranean Energy Market Integration Project
MED-ENEC	Euro- Mediterranean Project on EE in theConstruction Sector
MIT	Ministry of Industry & Trade
MPWH	Ministry of Public Works and Housing
MOF	Ministry of Finance
MPWH	Ministry of Public Works and Housing
NEEAP	National Energy Efficiency Action Plan
NEPCO	National Electric Power Company
NERC	Energy Research Program
PAP	Public Action for Water, Energy and Environment
RCREEE	Regional Center for Renewable Energy and Energy Efficiency
RE	Renewable Energy
REEEL	Renewable Energy & Energy Efficiency Law
REL	Renewable Energy Law

REEE II-TA	Renewable Energy &Energy Efficiency II-Technical Assistance
RSS	Royal Scientific Society
SEMP	Strategic Environmental Sustainability Management Plan
SWH	Solar Water Heaters
UNDP	United Nations Development Program
USAID	United States Agency for International Development
USD	United States Dollar
WAJ	Water Authority of Jordan
WB	World Bank

Introduction / What is Jordan's NEEAP?

The National Energy Efficiency Action Plan (NEEAP) is a national document that summarizes all the national efforts that are taking place in Jordan and sets the road map to be followed by the country towards reaching its objectives in energy efficiency. The first NEEAP for Jordan was developed in 2011 for the period 2012-2014. This current document presents the second NEEAP of Jordan for the period 2017-2020.

The Jordanian governments' energy sector policy has been expressed in the energy strategy 2007-2020 with three global main objectives dedicated to energy efficiency and renewable energy:

- Provide a reliable source of energy for the country, at the lowest possible cost;
- Increase the utilization of indigenous resources and renewable energies in order to increase energy supply security;
- Improve the efficiency use of energy in order to reduce oil imports, postpone the need for new investment in production facilities, and reduce the emission of Greenhouse and toxic gases to the environment.

More particularly, the strategy aims to reach the target of 20% improvement in energy efficiency by the year 2020. However, this strategy has to be operationalized through short and midterm action plans with concrete and feasible energy efficiency measures.

For that reason, in 2011 based on the contents of the Jordan Energy Strategy 2007-2020, Jordan has developed its first National Energy Efficiency Action Plan (NEEAP) for the period 2012-2014 that was adopted in 2011, according to the framework of the Arab Energy Efficiency Guidelines that was adopted by the Arab Ministerial Council for Electricity (AMCE) of the League of Arab States in their decision no. 195 taken in the 26th meeting held in 23 November 2010. The Ministry of Energy and Mineral Resources (MEMR) is hereby presenting this second NEEAP for The Hashemite Kingdom of Jordan for the period 2017-2020 (NEEAP 2017- 2020) to be adopted by the Cabinet. The MEMR is fully dedicated to implement this second NEEAP through the work with all major players involved. Through this Guideline, the Arab countries are requested to set EE target and assign an existing or a new public entity to draw a National Energy Efficiency Action Plan (NEEAP). The public sector should lead by example (exemplary role) and power utilities should provide services or contributing to implement EE measures. An annual progress report should be submitted to the LAS showing the achieved savings.

The template of the NEEAP proposed by the Directive is not mandatory, but a tool to assist the stakeholders to communicate essential measures and impact of their NEEAPs and will also assist the LAS to summarize and analyse the results to be published on an annual basis.

The NEEAP 2017-2020 is developed according to the format used by the Arab EE Guideline. Accordingly, the NEEAP starts by the national baseline to be used as reference against which actual savings are to be measured. The document also presents the national objectives to be reached by 2020. The importance of this document is that it sets the path towards the development of energy efficiency for years to come. The second NEEAP also includes all the

major players involved[1] in the application of the different measures, including a budget estimate for the application of these measures.

Jordan adopted the first NEEAP in 2011. The Ministry of Energy and Mineral Resources is hereby presenting the second NEEAP for The Hashemite Kingdom of Jordan for the period 2017-2020 (NEEAP 2017- 2020) to be adopted by the Cabinet. The MEMR is fully dedicated to implement this second NEEAP through the work with all major players involved.

The current document is developed by the REEE -TA project and the JREEEF team with the support and comment of many reviewers.

Background and Baseline

In 2011 and after the adoption of the Arab EE Guideline by the Arab Ministerial Council for Electricity (AMCE) in late 2010, Jordan did set its 2020 target as part of the development of its first NEEAP for 2012 to 2014. The baseline was used as the 5 years (2006-2010) average electricity consumption prior to the adoption of the Arab EE Guideline late in 2010[2], thus the 2020 target remains as 20% of the (2006-2010) baseline consumption of 11291 GWh resulting in 2258 GWh of cumulative electricity savings by 2020 as the 20% target.

The first Jordan NEEAP (2012-2014) has included 11 main measures and has set out the target to deliver 7.1% reduction in energy consumption by 2014, which equals to around 806 GWh[3].

According to the evaluation carried out by RCREEE in 2015 and completed early 2017 by the REEE II-TA project[4], the rate of completion (of the 11 measures in the first NEEAP) was estimated to 40% (324 GWh over the total of 806 GWh) as it is developed later on in the reporting part dedicated to the first NEEAP evaluation.

Under these conditions, Jordan has decided to develop the second official NEEAP for the period 2017-2020, with the ambitious target to save almost 2000 GWh[5] electricity by 2020. The NEEAP includes 34 measures (26 sectorial measures + 8 cross-cutting projects) covering residential, tertiary, industrial, water pumping and street lighting and transport sectors.

The present document develops the details of the new Jordan NEEAP according the template proposed by the Arab EE Guideline.

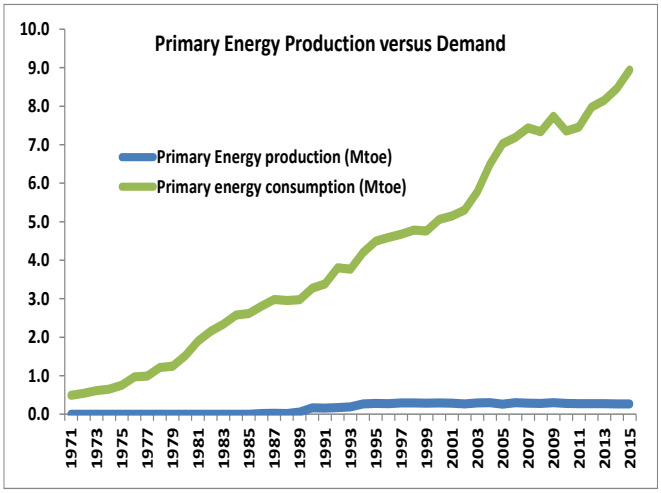
[1] Involved from the beginning in the preparation of this second NEEAP, from the National Consultations in the Dead Sea Workshop on 24-25 Feb. 2017 following by the NGOs meeting on 13 Mar. 2017, and the Donors meeting on 23 Mar. 2017.
[2] Which is equal to 11291 GWh per year (average consumption over the 5 years 2006-2010).
[3] In the addition to the main gaps identified in the first NEEAP 2012-2014, there is a calculation error made in the total energy reduction in all the sectors which is 806 GWh instead of 502 GWh in the previous document of the first NEEAP.
[4] The RCREEE review was based on incomplete information available at this moment. The REEE II-TA has updated it on more detailed information supplied on each measure over the 11 measures of the first NEEAP.
[5] exactly 1975 GWh.

Part 1: Current energy situation

1 Energy Dependency in Jordan

The trend of the primary energy (Production and Demand with an average annual growth of 7% of the energy needs) during the last four decades (1971 to 2015) show the huge increase of the energy dependency in Jordan.

In spite that the primary energy production has slightly increased (starting from small volumes, mostly based on the fossil fuels), the gap with the strong increased primary energy demand is becoming more important. Jordan imports more than 95% of its energy needs.



2 Energy demand

The primary energy demand has increased with an average of about 2.4% per year during the period 2005-2015 while the final energy consumption by 2.2% per year in the same period.

This growth was much less than the GDP that increased with the rhythm of about 4.4% per year for the same decade, showing a decoupling between the economic development and energy consumption.

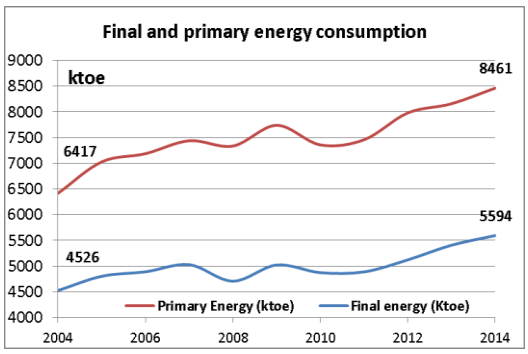


Figure 1: Final and primary energy consumption

The transport sector is the major energy consumer, with 48% of the final consumption in 2015 (43% in 2004), followed by the household (residential) sector (22%) and the industry (17%).

The electricity demand was rapidly increasing during the last decade. In fact, the consumption went from 8712 GWh in 2005 to 16173 GWh in 2015 increasing by around 6.4% per year, much higher than the economic growth.

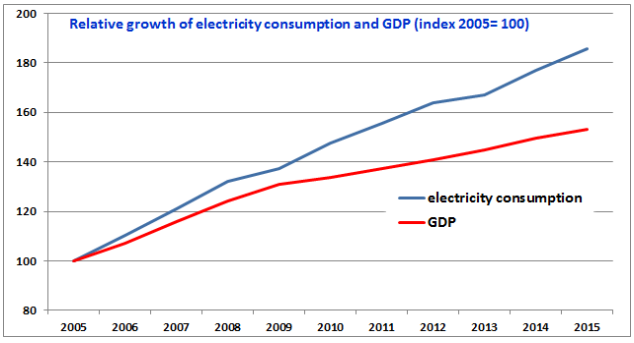


Figure 2: Electricity consumption & GDP growth

The peak load has also increased with a galloping rate of 7.3% from 1515 MW in 2004 to 3200 MW in 2015.

Regarding electricity consumption structure, the change was completely in the favor of residential sector which represented, in 2015, 43% of the consumption against 37% in 2005, while industry decreased from 31% to 25%. Just after the industry, the water sector registered increased electricity consumption for the water pumping (15%-16%).

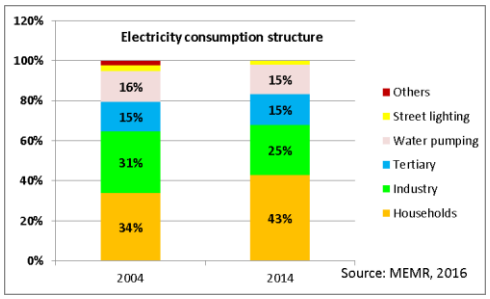


Figure 3: Electricity consumption structure

This can be explained by the improvement of households' power purchase increasing the acquiring of additional appliances. The electricity consumption of residential sector has increased with an annual rate of 8.5%, much higher than the total demand (6.4%).

3 Energy performance assessment

The energy efficiency of the overall economy of Jordan can be assessed through the evolution of its primary and final energy intensities. The primary energy intensity has decreased from 0.942 toe/1000 JD in 2005 to 0.728 toe/1000 JD in 2011, so a reduction of around -4.2%. The final energy intensity has decreased with higher rate - 4.9% in the same period. However, since 2011, both intensities have slightly increased with annual rate of 1.8% and 2.3% respectively showing some kind of degradation of the energy performance of the economy. On the overall period 2005-2015, the primary and final energy intensity has decreased with an annual rate of -1.8% and -2.1% respectively.

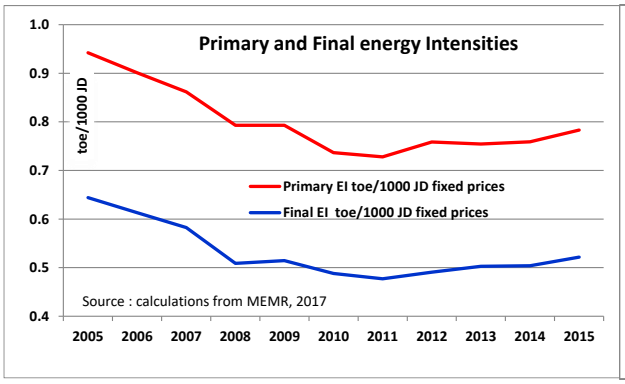


Figure 4 : Primary and final energy intensities

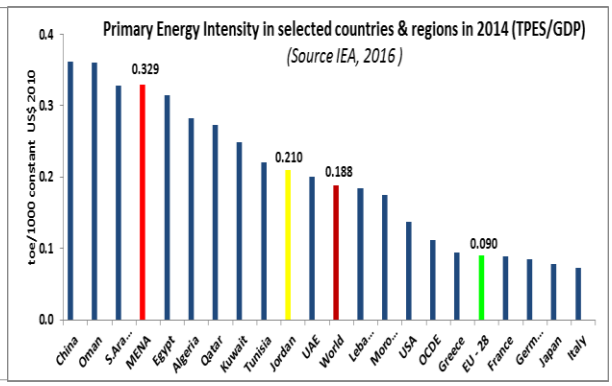


Figure 5 : Primary energy intensity of selected countries

Compared to other countries, the primary energy intensity of Jordan can be considered high. It is around 0.21 toe/1000 US$ of 2010, 1.2 times the world intensity and 4 times the average EU intensity.

The situation is worse when we consider the electricity demand which has increased much higher than the GDP. The electricity intensity has moved from 1168 kWh/1000 JD in 2004 to 1416 kWh/1000 JD in 2015, partly due to the switch from fuel to electricity in space and water heating.

The situation is quite different for the electricity generation which has shown an important improvement of the performance, mainly due to the introduction of gas fired power plants with higher efficiency. The specific consumption of the electricity generation has in fact dropped from 251 toe/GWh in 2004 to 211 toe/GWh in 2014, showing an improvement of around 2.5% per year.

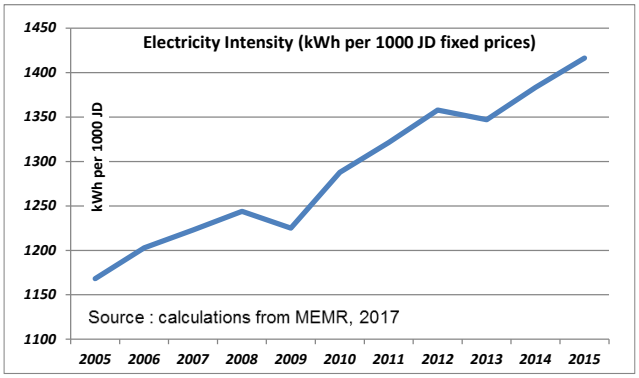


Figure 6 : Electricity intensity

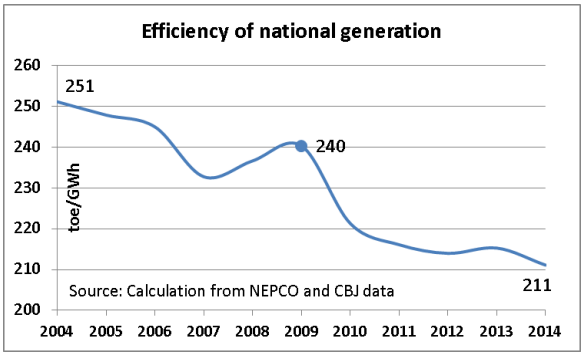


Figure 7 : Specific consumption of electricity generation

4 Evaluation of the first NEEAP 2012-2014[6]

In accordance with the Arab EE Guideline, the first National Energy Efficiency Action Plan (NEEAP) was developed for Jordan. It summarized ongoing and future actions and measures to improve energy efficiency in different sectors in Jordan during the period 2012-2014. As per the guidelines for the NEEAP, it set a clear vision for each of the sectors covered by the Action Plan, around which public and private sector actors can mobilize.

The first NEEAP set out a clear target to deliver 7.1% reduction in energy consumption by 2014, which equals around 806 GWh[7], as detailed in the following table:

Table 1: Indicative Target for the First NEEAP

	Average 5 years 2006-2010	NEEAP target by 2014	
	GWh	GWh	% of the 5 years average consumption
Total	**11291**	**806**	**7.1%**
Sector 1 Residential	4447	509	5.6%
Sector 2 Industrial	3013	100	3.3%
Sector 3 Commercial	1875	50	2.7%
Sector 4 Water Pumping	1668	85	5.1%
Sector 6 Street Lighting	288	19	6.6%

[6] The National Energy Efficiency Action Plan for Jordan, NEEAP 2012-2014, Ministry of Energy and Mineral Resources, 2013.
[7] In the addition to the main gaps identified in the first NEEAP 2012-2014, there is a calculation error made in the total energy reduction in all the sectors which is 806 GWh instead of 502 GWh in the previous document of the first NEEAP.

The first evaluation was done by the RCREEE for Arab countries including Jordan in 2015 through two documents referenced below[8], in addition to an analysis carried out by the EU funded project REEEII-TA in March 2017, summarized hereafter.

The RCREEE evaluation was done through the AFEX Energy Efficiency 2015, which provided an assessment of Arab countries' progress in energy efficiency (including Jordan) according to four evaluation categories: Energy Pricing, Policy Framework, Institutional Capacity, and Utility. Under these categories, countries are assessed according to nine different factors and 30 quantitative and qualitative indicators. The Arab Future Energy Index (AFEX) is the first native Arab index dedicated to monitoring and analysing sustainable energy competitiveness in the Arab region. AFEX offers both quantitative and qualitative analysis for key energy efficiency market dimensions. Countries are ranked under 30 indicators that illustrate key energy market aspects including policies, institutional and technical capacities, strategies, socioeconomic data and investments. AFEX data is collected through both international and local resources to guarantee accuracy and transparency. The AFEX Energy Efficiency 2015 ranked 17 Arab states including Jordan and provides tailored recommendations for countries to help improve their transition towards sustainable energy pathways.

In addition, RCREEE worked through questionnaires for ''Quantitative and statistical assessment work carried out to implement the Arab EE Guideline, with a Follow-up qualitative development and quantitative impact survey for 2014''.

As far as Jordan is concerned in the Arab AFEX EE 2015, Jordan ranks the second after Tunisia in creating favourable environment for energy efficiency investments. The main accomplishments of Jordan during the 2014 include implementation of subsidy removal plan, whereby it eliminated all subsidies for oil products; adoption of its first national energy efficiency action plan in 2011 (2012-2014); and formulation of minimum energy performance standards for household appliances. However, during this first plan (2012-2014), Jordan still needs to strengthen its implementation capacity to properly capitalize on introduced energy efficiency policies and ensure coordination among various stakeholders. Concerning the EE Provisions in the National Energy Strategy, in 2014 there is long-term Strategic Orientation with EE objectives decided in Jordan as the **Jordan National Energy Strategy 2007-2020 was adopted and reflected Jordan motivations for pursuing EE.** As oil importing country**, EE is a necessity and a matter of energy security in Jordan**. With rising and volatile international prices for oil and gas, **Jordan simply cannot afford wasteful consumption of energy**.

On November 25, 2010, the Arab Energy Efficiency Guidelines were adopted based on the European Directive 2006/32/EC on energy end-use efficiency and energy services. According to the guidelines, Arab states are required to set an indicative target for 2020 and develop

[8] a) RCREEE, Quantitative & statistical assessment carried out to implement the Arab EE Framework: Follow-up qualitative development & quantitative impact survey for 2014, RCREEE, 24 Dec. 2014.
b) RCREEE, Arab Future Energy Index (AFEX Energy Efficiency 2015).

national energy efficiency action plans (NEEAPs) to achieve comprehensive energy savings target by 2020. The **NEEAPs are to be prepared for a period of three years with an indicative target for energy savings**. Arab countries are also required to assign the responsibility for oversight, coordination and reporting to one or more, new or existing, authority or agency (Arab Ministerial Council for Electricity, 2010). On this basis, Jordan adopted its first official EE plan (**NEEAP 2012-2014)** by the Ministry of Energy and Mineral Resources (MEMR), *see the table above.*

The status of EE laws and implementing Bylaws in Jordan is under the framework of the **Jordan Law No.13 adopted in 2012 on energy efficiency & renewable energy**. In Jordan, the implementation was through Bylaw No73 (2012) on Regulating Procedures and Means of Conserving Energy and Improving Its Efficiency Issued by virtue of Article (18) of the Energy Efficiency and Renewable Energy Law No 13 (2012).

Sector 1 Residential/ individual EE measures **(5 measures)**

Sector 1 Residential, Measure 1 *(Replacement of 1.5 million incandescent lamps with energy efficient lamps, CFL)/ Rate of completion 20% (49.2 GWh over 246 GWh).*

Among Jordan first NEEAP (2012-2014), there were two measures on **Lighting** over a total of 11 measures. The NEEAP measure number 1 (listed over 11 measures) was the replacement of 1.5 million incandescent light bulbs with CFLs in the Residential sector, mainly in the low consumption residential sector (USD 7.14 million) targeting 246 GWh energy savings by 2014. The implementing agency was the Ministry of Energy and Mineral Resources together with distribution companies. The rate of completion is estimated to 20% (49.2 GWh over 246 GWh).

Sector 1 Residential, Measure 2 *(Energy Label program for four home appliances)/ Rate of completion 100% (91 GWh).*

Standards and labelling for household appliances were adopted on 2014, as Jordan refrigerators; air conditioners; washing machines Mandatory were adopted in 2014. The rate of completion is estimated to 100% (91 GWh).

Sector 1 Residential, Measure 3 *(Installation of 30,000 Solar water heaters)/ Rate of completion 10% (15 GWh over 147 GWh).*

About 10% of the planned Solar Water Heaters (SWHs) were installed regarding the target for this measure. Then the rate of completion is estimated to 10% (14.7 over 147 GWh).

Sector 1 Residential, Measure 5 *(Installation of 5,162 Solar water heaters in cooperation with Jordan River Foundation)/ Rate of completion 70% (17.5 GWh over 25 GWh).*

According to JREEEF, a total of 3600 SWHs were installed over the 5162 SWHs. The rate of completion is estimated to about 70% (17.5 GWh over 25 GWh).

Related to measures 3 &5 for Solar Water Heaters (SWHs) above, the statutory obligation to install SWHs to improve energy performance in the building sector by integrating renewable energy sources (as SWHs) in the building system, Jordan require mandatory installation of SWHs in new buildings exceeding 250 m2; in apartments exceeding 150 m2; and in offices

exceeding 100 m2 (Article 10, Bylaw No 73). Jordan increased the rate of SWH diffusion from 162 m2 per 1,000 inhabitants in 2012 to 182 m2 per 1,000 inhabitants in 2013 (compared to the diffusion of SWHs in the Arab region which still remains relatively low with the exception of Jordan and Palestine).

Sector 2 Industrial/ Measure 6 *(Mobile Energy &Environment Clinic)/Rate of completion 100% (80.4 GWh over 80.4 GWh)*

In Industry sector, the Jordan energy situation drastically deteriorated when the cheap natural gas supply from Egypt stopped as gas pipelines linking Egypt to the region were repeatedly attacked. Jordan last received gas from Egypt in January 2014 (Kelly, 2014), with subsequent negative effects on most manufacturing industries. For example, one of the largest Jordanian pulp and paper factories installed a co-generation unit some years ago, but due to the lack of fuel supply, the plant never became operational. **For the industrial EE policies in Jordan,** the measures during the first NEEAP period 2012-2014 were:

- ✓ The Bylaw No 73 (2012) on Regulating Procedures and Means of Conserving Energy and Improving Its Efficiency Issued by virtue of Article (18) of the Energy Efficiency and Renewable Energy Law No 13 (2012).
- ✓ Any entity, whose annual energy consumption exceeds 50 toe per year, shall be subject to the mandatory and periodic energy audit carried out by the licensed entities.

In addition, a previous programme launched in 2009 aiming to improve EE in industrial facilities in Jordan, the programme "Mobile Energy and Environment Clinic Program", was initiated by Amman Chamber of Industry. The program provided full energy audits and offers support to cover 90% of energy audit costs. The rate of completion was achieved to 100% (80.4 GWh).

Sector 5 Street Lighting/ Measure 9 *(Replacement of Mercury lamps by efficient lamps and use automatic street lighting controls and voltage regulators)/ Rate of completion 60% (11 over 19 GWh)*

Jordan's first NEEAP includes a ninth measure (listed over the 11 measures) to replace 100,000 inefficient mercury street lights with more efficient lamps while using automatic street lighting controls and voltage regulators. The estimated program cost was USD 9.15 million, with 86 GWh of energy savings targeted by 2020. **Jordan has identified street-lighting as a priority in the EE sector.** In 2014 Jordan technical regulations for lighting products with minimum EE classification requirements was adopted, and positive developments observed in the country with the adopted minimum energy performance standards for lighting products. During the first NEEAP where the target was fixed to 19 GWh, the rate of completion was estimated to 60% (11.4 GWh over 19 GWh).

Public sector: exemplary role/ **Measures 10 & 11** *(Reduce the consumption of public buildings by 10% + Replacement of 50,000 of incandescent lamps with compact fluorescent lamps, CFL)l Rate of completion 30% and 10% (9.9 &0.9 GWh over 33 & 9 GWh).*

Concerning the status and type of **EE regulations for buildings**, it was adopted mandatory EE building regulations in Jordan as mentioned below:

- ✓ Thermal Insulation Code (1998): Prescriptive.
- ✓ Energy conservation building code (2010): Prescriptive (Mandatory for the residential buildings when the ratio of the net floor area is less than four times the roof area).
- ✓ Solar energy building code (2012): Prescriptive (Mandatory for buildings when the net floor area is more than four times the net roof area).

Among other initiatives to improve the situation with implementation of EE buildings includes USAID funded "Jordan Competitiveness Program," which aims to facilitate the construction of 20% of the new building stock according to EE building regulations, and to retrofit 5% of existing buildings (JCP, 2014). The program plans to implement the following activities: (1) organizing compliance trainings to key stakeholders in the construction sector; (2) developing a compliance manual; (3) developing compliance forms and inspection procedures; (4) building pilot projects; (5) community outreach and information awareness; and (6) establishment of an appropriate energy code administration structure with the mandate, authority and resources to ensure proper enforcement of the EE building code. The rate of completion of the two measures is estimated respectively to 30% and 10% (respectively 9.9 & 0.9 GWh over 33 & 9 GWh).

Sector of Transport: This sector was not included in the first NEEAP but as the first energy final consuming sector in Jordan, it's considered in this evaluation regarding its actions towards improving EE results. As far as the programs to improve Public Transport is concerned, Jordan adopted, during the period 2012-2014, Amman Bus Rapid Transit (BRT) and Amman-Al Zarqa Light-Rail project. In addition, regarding the hybrid cars. Jordan is the only Arab country in the region that provides in 2013 **tax incentives for hybrid cars** (Jordan, Taxes and Duties 2013), in addition to the exemption from sales tax and customs duties for EE equipment.

Funds for EE projects: **Concerning the status of EE Funds in Jordan,** Jordanian Renewable Energy and Energy Efficiency Fund (JREEEF) was established in May 2012 by the Law on Energy Efficiency and Renewable Energy (2012), as a department at the Ministry of Energy and Mineral Resources. During the initial period of the first NEEAP, JREEEF had not been operationalized yet. Its annual budget allocations are coming from foreign donations. Among the first support, it was the World Bank project "Energy Efficiency Investment Support Framework Project for Jordan" contributing to improve EE investments in commercial and industrial sectors by operationalizing the JREEEF. The operationalization of the Fund includes building the technical capacity of JREEEF, implementing media awareness and outreach activities, and conducting energy audits in public buildings and industrial facilities (World Bank, 2013).

CONCLUSION :

According to the analysis carried out by the EU funded project REEEII-TA in March 2017 which complete the preliminary quantitative evaluation carried out by the RCREEE in 2015, two measures where completed at 100% and 3 measures were implemented at a rate of 60-80%, but only 6 measures were noted for their insufficient completion as their rates were between 10% and 40%. **These results of achievement of the 11 measures of the first NEEAP** (as mentioned in the below detailed table of results), **allowed to reach 40% of the 2014 target of the first NEEAP, but the qualitative evaluation was raised that many EE policies were put it in place during this period 2012-2014.**

Table: Rate of the completion of the 11 measures of the first NEEAP 2012-2014

measures	Sectors	Title of the 11 measures	Average 5years 2006-2010	Target by 2014		Rate of completion	
				%	GWh	%	GWh
	Residential		**4447**	**5.6%**	**509**	**34%**	**172**
1	*Residential*	*Replacement of 1.5 million incandescent lamps with energy efficient lamps (CFL)*			*246*	*20%*	*49.2*
2	*Residential*	*Energy Label program for four home appliances*			*91*	*100%*	*91.0*
3	*Residential*	*Installation of 30,000 Solar water heaters*			*147*	*10%*	*14.7*
4	*Residential*	*Survey of energy consumption in Residential sector by the end of 2012*				*100%*	
5	*Residential*	*Installation of 5,162 Solar water heaters in cooperation with Jordan River Foundation*			*25*	*70%*	*17.4*
6	**Industrial**	Mobile Energy and Environment Clinic	**3013**	**3.3%**	**100**	**80%**	**80.4**
7	**Commercial**	Replacement of conventional Ballasts by Electronic Ballasts for fluorescent Lamps	**1875**	**2.7%**	**50**	**30%**	**15.0**
8	**Water Pumping**	Phase 1-Improvement of Energy Efficiency of the Water Authority of Jordan (IEE) & Phase 2- (EEP)	**1668**	**5.1%**	**85**	**40%**	**34.1**
9	**Street Lighting**	Replacement of Mercury lamps by efficient lamps & use Automatic street lighting controls & voltage regulators	**288**	**6.6%**	**19**	**60%**	**11.4**
10	**Public sector**	Reduce the consumption of public buildings by 10%			**33**	**30%**	**9.9**
11	**Pubic sector**	Replacement of 50,000 of incandescent lamps with compact fluorescent lamps (CFL)			**9**	**10%**	**0.9**
		Total of the 11 measures	**11291**	**7.1%**	**806**	**40%**	**324**

In fact noticeable that EE policies/institutions were put in place during the first NEEAP, as the Jordanian Energy Strategy 2007-2020, the Jordan Law No.13 on energy efficiency & renewable energy and Bylaw No739 adopted in 2012, in addition to the launching of the Jordanian Renewable Energy and Energy Efficiency Fund (JREEEF) which was established in May 2012 by the Law on RE &EE (2012). JREEEF has been operationalized progressively during this first period 2012-2014.

[9] Regulating Procedures and Means of Conserving Energy and Improving Its Efficiency Issued by virtue of Article (18) of Law No13-2012.

Part 2: Long term energy Efficiency scenarios in Jordan

1 Future scenarios description and main assumptions

The long term energy system forecast was done by using the TIMES Energy System Model[10]. TIMES is a bottom-up, partial equilibrium optimization model of energy system, based on least cost approach.

Two scenarios were developed for Jordan by using this model: A Business as Usual Scenario (BaUS) considered as reference scenario and an Energy Efficiency scenario (EES).

The Business as Usual scenario assumes that the current trend of the energy performance is continued in the future in all sectors. In this case no additional significant EE programs will be implemented and only the natural improvement of the efficiency of the replaced equipment is considered.

1.1 Main assumptions

The main macroeconomic and demography forecast used for both Scenarios are those developed within the 3rd National Communication of Jordan. For the GDP at constant prices it should increase from 11419 million JD in 2015 to around 19535 million JD in 2030. The average growth rate considered is 3.7 % up to 2020 and 3.4% from 2020 to 2030.

The economic structure will remain dominated by the services sector with a share of 67%; however, the share of industry in the GDP will slightly increase from 29.8% to 30.7% in 2030.

It is assumed that the population of Jordan will increase with an average rate of around 1.74% per year for the period 2015-2030 (against 1.76% in the period 2005-2015).

In this case the number of dwellings will increase from 1.67 million dwelling in 2014 to 2.37 million dwelling in 2030, which means an average annual increase of 2.2%.

For services, the stock of building estimation was based on the survey carried out by MEMR on the energy consumption of the services sector, as presented in the following table.

[10] The forecast of scenarios was done by the expert George Giannakos's, within the EU TA project

Table 2: Main macroeconomic and demographic assumptions

Sub-sector	Number of units (1000) in 2014	Assumption on the future increase
Tourism Sector	7.11	Growth rate of the Service sector Value Added
Health (Hospitals and Clinics)	4.82	Population growth rate
Commerce	73.28	Growth rate of the Service sector Value Added
Education	6.41	Population growth rate
Offices	2.74	Growth rate of the Service sector Value Added

The table presents also the assumptions considered for each type of building to forecast the stock of buildings up to 2030.

1.2 Scenarios definition

1.2.1 The Business as Usual Scenario (BaUS)

The BaUS is defined by continuing the same current trend for the future in term of energy demand and energy performances. However, market improvement of the energy performance of appliances and equipment was considered.

1.2.2 Energy Efficiency Scenario (EES)

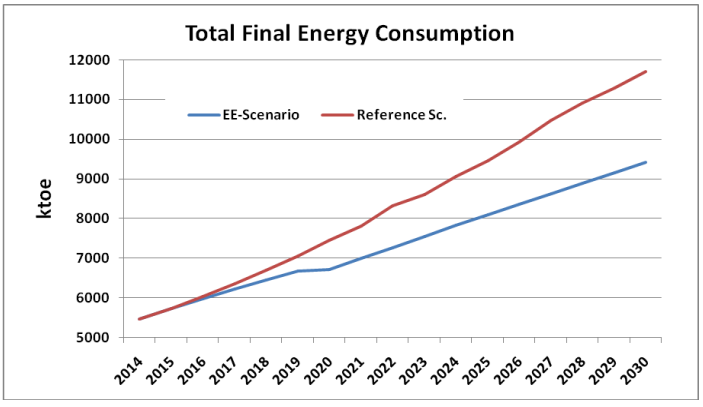
For the EES, the penetration rate of efficient equipment in residential and commercial sectors (heating, cooling and lighting) was increased (see annexes). Also, the specific consumption of large industries (cement, fertilizer, etc.) has improved to meet international standards.

For transport hybrid and electrical cars were introduced and will reach 90000 vehicles by 2020. Also, the forecast has taken into account the introduction of electrical Railway transport for freight from Aqaba to Amman (after 2020) as it was expected by the transport strategy.

2 Energy demand

2.1 Global trends

According to the EES, the final energy demand will increase from 5617 ktoe in 2014 to 6519 ktoe in 2020 and then to 8476 ktoe by 2030, so an average annual growth of 2.6% between 2014 and 2030 is anticipated. The annual growth rate of the final demand according to the



BaUS will be around 3.8% per year.

The energy saving that will be achieved by the EES compared to the BaUS will be around 9% in 2020 and 14% by 2030.

For electricity demand, the demand will increase with an annual average rate of 4.7% and 4.1% respectively in the case of the BaUS and the EES. The EES will allow electricity saving, compared to the BaUS, of 12% by 2020 and 10% in 2030, as shown by the flowing charts.

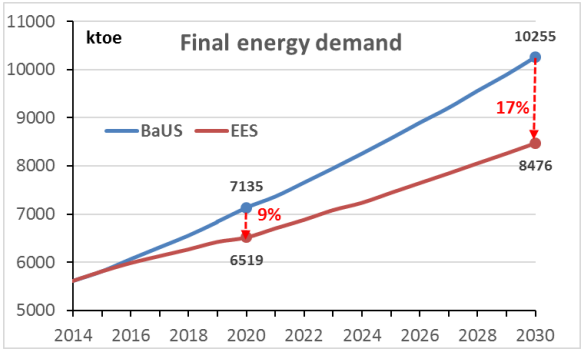


Figure 8 : Forecasted final energy demand

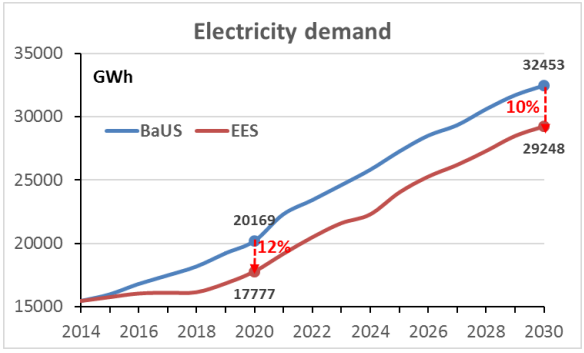


Figure 9 : Forecasted electricity demand

The decrease of the saving ratio of electricity to 10% in 2030, while it is 12% in 2030, can be explained by the development of the use of electrical cars and electrified railway transport. This is translated as demand switch from fuel to electricity. In fact, the electricity consumption in the transport sector in 2030 is estimated to 3010 GWh according to the EES and only 660 GWh in the BaUS case. Without considering transport, the electricity demand will be reduced by round 17% in 2030 compared to the BaUs.

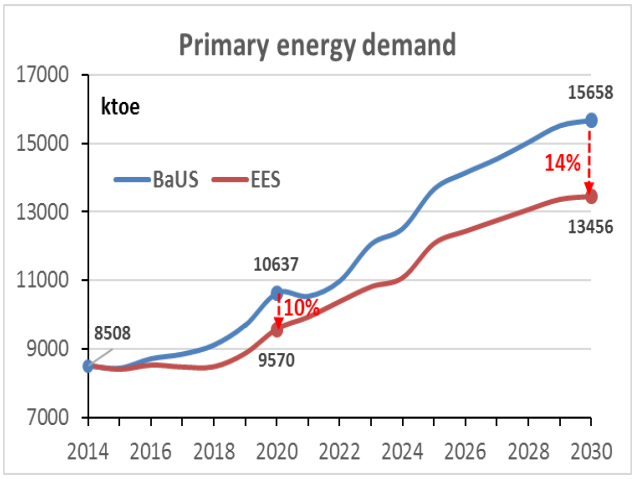


Figure 10: Forecasted primary energy demand

Regarding, the primary energy, the demand will increase, according to the EES, from around 8500 ktoe in 2014 to 9570 ktoe in 2020 and 13460 ktoe by 2030. Compared to BaUS, the primary energy demand of the EES will be lower by 10% in 2020 and 14% by 2030.

2.2 Sectors' demand

For both scenarios, the transport will remain the main energy consuming sector with a share of about 52% (54% for the EES) in 2030 against 48% of final energy in 2014. One can also notice the decrease of the share of industry and residential sectors in 2030, respectively from 19% to 15% and from 20% to 17% for the EES. This share will be 17% and 19% respectively in the case of the BaUS as shown by the following charts.

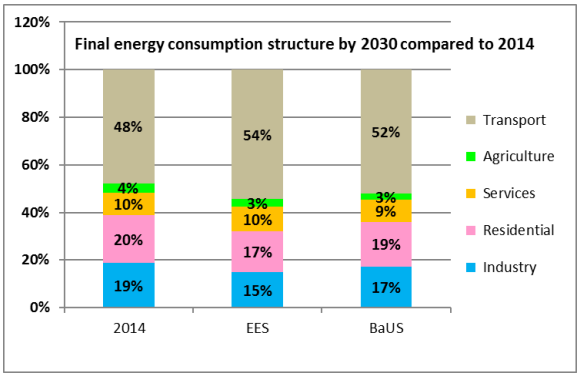


Figure 11 : Final energy consumption structure by 2030 compared to 2014

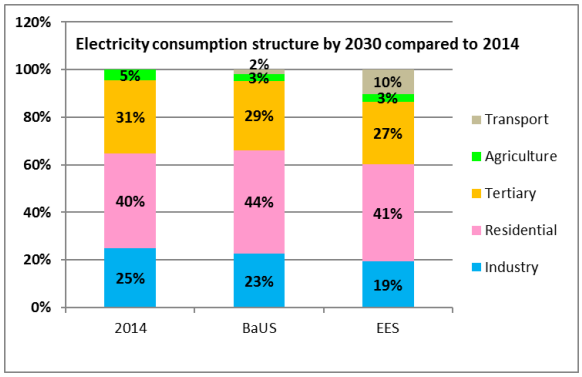


Figure 12 : Electricity consumption structure by 2030 compared to 2014

For electricity, the residential sector will remain the first consumer with more than 40% of the total consumption. The industry consumption share will decrease significantly from 25% in 2014 to 19% in 2030 in the case of the EES. The same trend is observed for the share of tertiary sector. Thus decrease will be compensated by the transport sector whose consumption will reach a share of 10% of the total electricity consumption in 2030 in the case of the EES.

The following table presents the final energy demand forecast for the main sectors. It shows that most important saving, in term of % of the BaUS demand, will be in industrial and residential sectors in 2020. It will reach 14% and 16% respectively and 28% and 24% by 2030. The transport sector will show an important saving on the long term, with the introduction of the train transport after 2025 (14% in 2030).

Table 3: Final Energy consumption per sector according to BaUS and EES (ktoe)

Sector	2015	2020			2030		
		BaUS	EES	Saving	BaUS	EES	Saving
Industry	991	1257	1075	-14%	1772	1269	-28%
Residential	1272	1424	1203	-16%	1923	1459	-24%
Tertiary	754	647	614	-5%	948	858	-9%
Transport	2810	3552	3372	-5%	5332	4610	-14%

The following charts present the electricity demand by sector in 2020 and 2030.

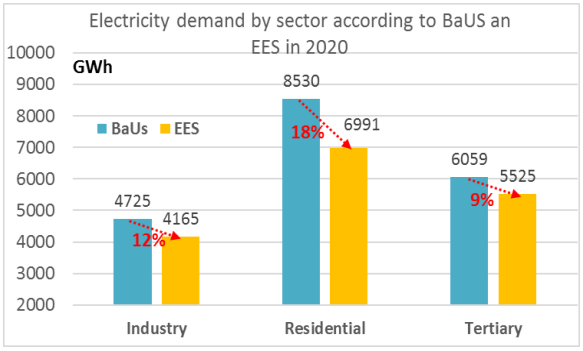


Figure 13 : Electricity demand by sector according to BaUS and EES in 2020

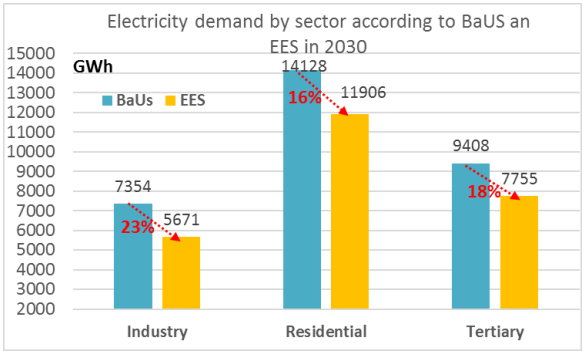


Figure 14 : Electricity demand by sector according to BaUS and EES in 2030

On the short term, the residential sector is expected to show the highest saving with the EES implementation, compared to BaUS (18% in 2020). On the long term, the energy saving in term of % of the BaUS will the highest in the industrial sector (23% in 2030), followed by tertiary sector (18% in 2030).

3 Main impacts of the EES

3.1 Energy saving

The implementation of the EES will allow an accumulated final energy saving of about 1570 ktoe between 2016 and 2020 and 13500 ktoe to 2030. The electricity saving will be around 9120 GWh up to 2020 and 40960 GWh up to 2030.

Table 4: Accumulated energy saving according to EES compared to BaUS (ktoe)

	2016-2020	2016-2030
Primary energy (ktoe)	3 183	18 394
Final energy (ktoe)	1 568	13 493
Electricity (GWh)	9 123	40 957

The final energy saving will be around 18400 ktoe between 2016 and 2030.

3.2 Energy performances

In the case of the BaUS, the final energy demand will grow faster than the GDP which is translated in an increasing final energy intensity. The EES have a deceleration impact of the final energy demand evolution which will grow much less than the GDP, showing a decrease of the energy intensity.

For electricity, despite the energy efficiency effort in the EES, the electricity will grow faster than the GDP after 2020 with the introduction of the electrified railways transportation. Hence the electricity intensity will go down from 1.38 MWh/1000 JD in 2020 to 1.28 MWh/1000 JD in 2020 than increase to 1.5 MWh/1000 JD by 2030.

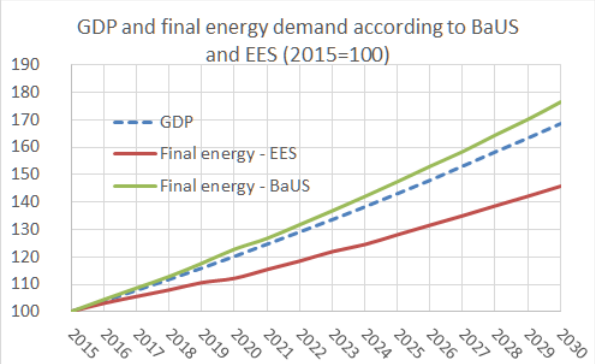


Figure 15 : GDP and final energy demand according to BaUS and EES (2015=100)

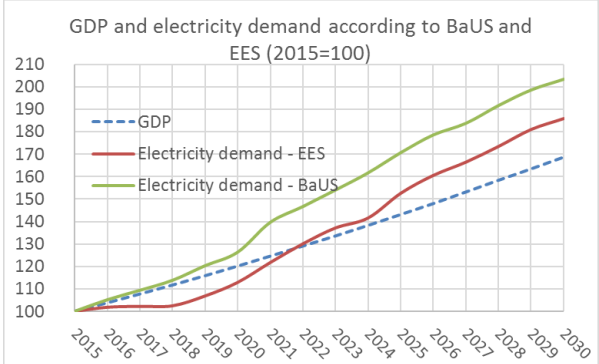


Figure 16 : GDP and electricity demand according to BaUS and EES (2015=100)

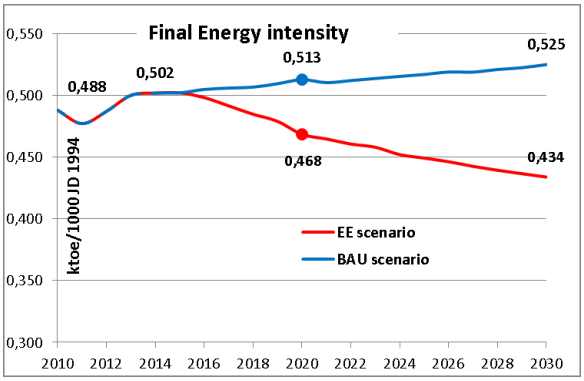


Figure 17 : Forecasted final energy intensity

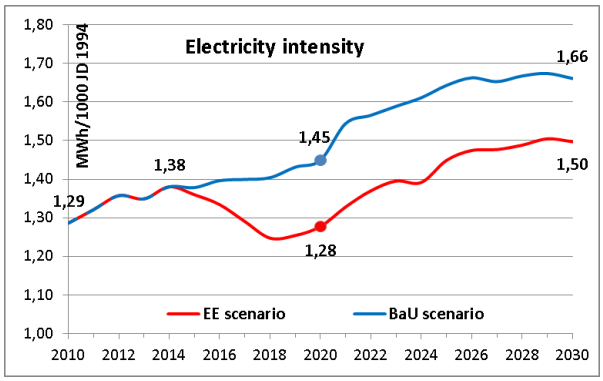


Figure 18 : Forecasted electricity intensity

3.3 Energy bill saving

Based on the IEA energy price scenario, the following chart shows the yearly energy bill saving for Jordan due the implementation of the EES.

Cumulated, this energy bill saving will be more than 10 billion USD for the period 2016-2030 and around 1.3 billion USD during the period 2016-2020.

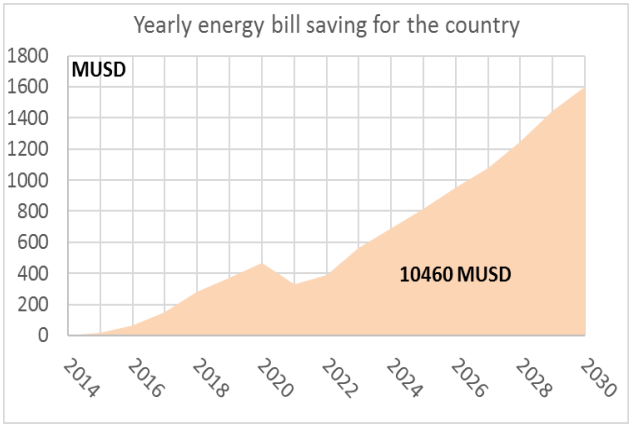


Figure 19: Yearly energy bill saving for Jordan

3.4 CO2 emissions reduction

The CO_2 emission will be around 31 $MtCO_2$ in 2030 according to the BaUS, however it will be only 25 $MtCO_2$ according to the EES. For the EES, it will be an absolute decrease of CO_2 emission in 2030 compared to 2014. The carbon intensity will decrease from 2.35 tCO_2/1000 JD in 2014 to 2.22 tCO_2/1000 JD in 2030, as shown by the following charts.

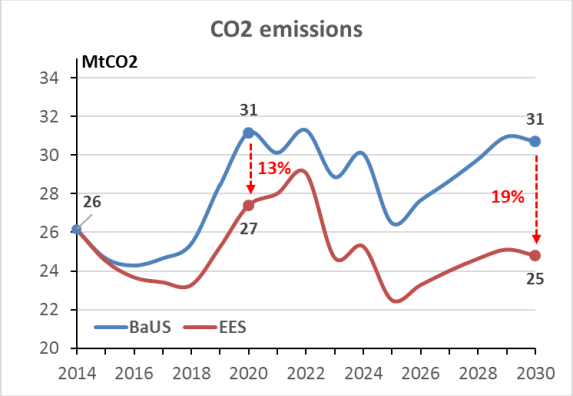


Figure 20 : Forecasted CO2 emissions by scenario

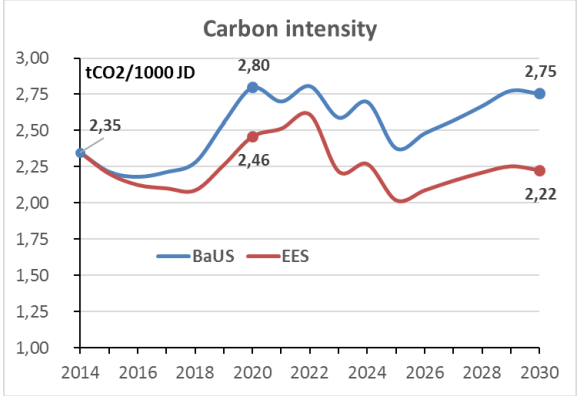


Figure 21 : Forecasted carbon intensity by scenario

For both scenarios an important drop of the emissions and the carbon intensity is observed after 2022 with the introduction of the nuclear power plants. The effect of the nuclear power plant introduction can be clearly demonstrated by the forecasted evolution of the electricity sector emission factor.

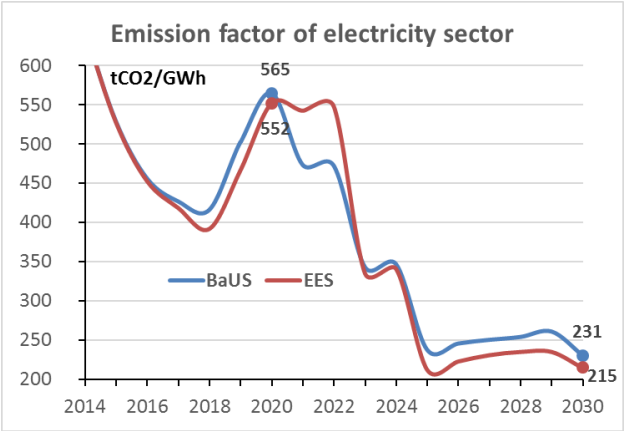


Figure 22: Forecasted emission factor of electricity sector

Part 3: The energy efficiency midterm action plan: NEEAP

1 Overview: Overall national indicative target

1.1 Key indicators

Table 5: Key energy indicators for Jordan

Indicators	Unit	Year 2015	Year 2020
Electricity intensity	GWh/1000 JOD	1416	1368
National end use electricity consumption	GWh/year	16178	18751
Projected electricity consumption growth rate	% /year	3.0%	
Share of electricity in final energy consumption	%	23.1%	23.3%
Share of electricity consumption by sector			
Sector 1: Residential	%	44.7%	39.6%
Sector 2: Industrial	%	23.6%	25.1%
Sector 3: Commercial & Services	%	14.7%	17.2%
Sector 4: Water Pumping	%	14.9%	15.3%
Sector 5: Street Lighting	%	2.1%	2.6%
Marginal cost of kWh supplied (2014)	USD/kWh	0.199[11]	

1.2 Summary of the results of the new NEEAP

1.2.1 Calculation methodology of NEEAP electricity savings target for 2020

According to the LAS directive, Member States shall use the end use electricity consumption for the most recent five-year period prior to the adoption of the Guideline in late 2010 for which official data are available, to calculate an average amount of annual electricity consumption to be used as reference for the NEEAP target. This electricity shall constitute the average amount consumed during the five-year period, not adjusted for degree days, structural changes or production changes.

The period of the new NEEAP of Jordan is **2017-2020**.

The indicative electricity savings target for the year 2020 of the NEEAP should be presented as a % of the average electricity consumption of the period 2006-2010. This target should be supported by measures listed and described in the national NEEAP. The calculation to reach this target is based on accumulated accounting of annual electricity savings.

[11] Fuel cost :139.5 Fils/kWh, NEPCO, 2015

1.2.2 Indicative target of the second NEEAP (2017-2020)

The national indicative target is to be calculated according to the methodology presented above and drawn from the detailed EE measures that will be detailed below. The table below presents the summary of the NEEAP results by 2020.

Table 6: Indicative Target for the Updated NEEAP

	Baseline 5 years average consumption 2006-2010 (GWh)	Saving according to NEEAP 2017-2020 (GWh)	% of 5 years average baseline consumption
Residential	4447	998	**22.4%**
Industrial	3013	383	**12.7%**
Commercial & services	1875	376	**20.0%**
Water Pumping	1668	163	**9.8%**
Street Lighting	288	55	**19.1%**
Total	**11291**	**1975**	**17.5%**

With the achieved savings of 324 GWh from the 1st NEEAP and upon the successful completion of the 2017-2020 NEEAP, Jordan will achieve a total savings of 2,299 GWh, thus the 20% target of 2,258 GWh by 2020 based on the Arab EE Guideline will be achieved.

1.2.3 Main impacts of the NEEAP

The total investment cost of the new NEEAP is estimated to be around 696 million JD (994 million USD) and will generate an annual saving for the user of about 230 million JD (329 million USD) per year by 2020. In this case the average payback period of the NEEAP from the point of view of the users will be around 2.5 years which represents a good profitability. The average cost of the saved kWh can be estimated to be around 0.088 JD/kWh (0.126 $/kWh).

Table 7: Main NEEAP impacts indicators

	Saving according to NEEAP by 2020 (GWh/year)	Investment cost (MJD)	Users bill saving by 2020 (MJD/year)	CO2 emission reduction by 2020 (ktCO2/year)
Residential	998	301	116	467
Industrial	383	105	53	179
Commercial & services	376	133	41	176
Water Pumping	163	141	15	151
Street Lighting	55	16	6	26
Total	**1975**	**696**	**230**	**999**

In term of environmental impact, the NEEAP will allow an emission reduction of CO_2 of about 999 $ktCO_2$ per year by 2020. The cost of the reduced CO_2 emission will be around 0.174 JD/tCO_2 for the period of the NEEAP[12].

2 Planned and ongoing EE measures at sector's level

2.1 Residential Sector (4 measures)

For residential sector, 4 main energy efficiency measures are proposed to be implemented during the period 2016-2020, as summarized in the following table:

Table 8: Summary of EE measures in residential sector

No	Measures	Description	Period	Electricity saving (GWh)	Program Cost (MJD)	Bill saving for users (MJD)
1	Replacement incandescent lamps with LED for low and medium households income classes (<600 kWh/month)	1 million LED targeting 250000 consumers	2017-2020	155	10	12
2	Enforcement of Energy Label and standards program for 4 home appliances	Air conditioning - Refrigerators - Freezers - W machines	2017-2020	400	NA	21
3	EE building codes enforcement in residential sector (just insulation)	About 66000 new households during the next 5 years.	2017-2020	401	259	75
4	Program for roof insulation of existing building in residential sector	15000 houses with around 2 million m^2 of roof	2017-2020	41	32	7
	Total			**998**	**301**	**116**

According to the EES presented above, the target of electricity saving compared to the BaUS in the residential sector should be around 1540 GWh in 2020. Hence, the total saving expected from the NEEAP implementation would represent around 65% of the EES target.

The total required investment to implement the measures is around 301 MJD (430 MUSD) and will allow a bill saving for the households of about 116 MJD (164 MUSD) per year by 2020. The CO_2 emission reduction will around 467 $ktCO_2$ by 2020.

The individual measures are detailed below.

[12] or 0.035 JD/tCO2 for the life cycle.

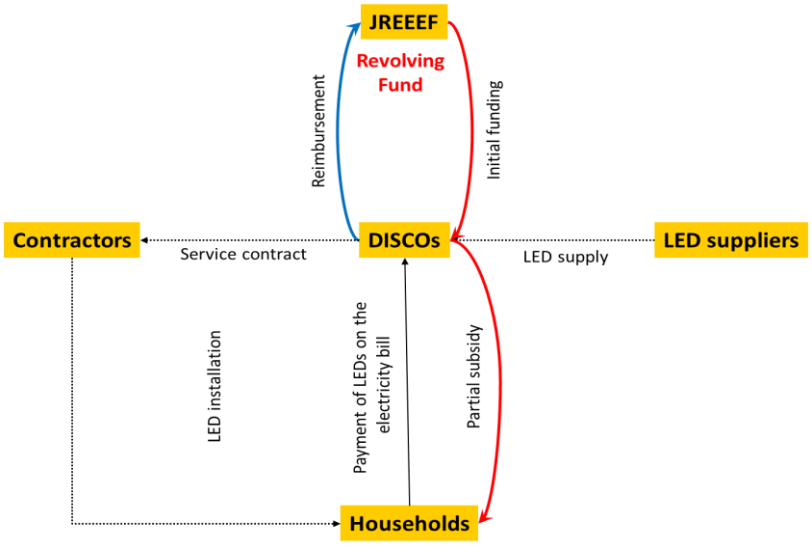
2.1.1 MEASURE 1: Replacement of incandescent lamps with Light Emitting Diodes (LED) lamps in Residential Sector

Measures	**Replacement of incandescent lamps with Light Emitting Diodes (LED) lamps in Residential Sector**
Objective	This initiative aims at promoting Light Emitting Diodes (LED) lamps and enhancing the confidence of Jordanian citizens on the benefits of utilizing LED lamps.
Description of the measure	This measurer intends to distribute 1 million E27-LED Lamps for residential sector (specifically for low consumption households class (< 600 kWh/month). In addition, energy efficiency, the objective is also to reduce energy poverty and vulnerability of the poor and medium classes. The Government of Jordan represented by the Ministry of Energy and Mineral Resources (MEMR) and particularly JREEEF will initiate this process and distribute 1 million LED lamps. The lamps will be distributed through the electricity distribution companies (DISCOs), but a clear mechanism & methodology for distributing these lamps should be prepared and agreed among relevant parties. In addition, a mechanism for collecting the replaced incandescent lamps will be prepared and arranged prior to the distribution of lamps to insure that all LED lamps will go to the right place.
Implementing agency	MEMR and particularly JREEEF will be in charge and supervise the whole implementation of the program.
Stakeholders involved	The three distribution companies (JEPCO, EDCO and IDECO) will support this program. NERC/RSS also could be involved in the whole implementation process. EMRC, NEPCO and Local Suppliers of LEDs are also involved.
Target group	Residential sector of consumption < 600 KWh/month
Program cost	It is estimated that the program will cost 12 million JD (21.2 million USD).
Cost / kWh saved	It is estimated that the cost of each KWh saved will be 0.004 JD/kWh (0.006 USD/kWh).
Impacts of the program	Replacement of incandescent lamps with efficient LED lamps will allow a saving of electricity of about 155 GWh per year by 2020. Moreover, it will reduce the load demand by 102 MW based on the assumption that of 80% of the replaced Lamps were contributing to the peak demand. The distribution companies sell electricity to the residential consumer especially for low consumption category at prices lower than the actual cost of kWh. If this measure is implemented, it will lead to a significant reduction in subsidies given to those consumers. Finally, it is estimated that the annual reduction in CO_2 emission will be around 73 ktCO2 per year by 2020.

Source of funding	JREEEF and households
Financial instruments	The revolving fund of JREEEF will be used partly to finance the investment cost of the LED. The beneficiaries will pay the balance of the cost of the LEDs through the monthly electricity bill on duration of 1 or 2 years (see scheme below). In term of incentive, the Government of Jordan has exempted all energy efficiency and renewable energy equipment including LEDs from custom duties and sales tax according to the By-Law of Exempting Renewable Energy & Energy Efficiency Equipment, which led to a significant reduction in their market prices for the end user.
Awareness	The implementation of this measure will be accompanied with an effective awareness campaign addressing both consumers and LED suppliers. This campaign will take advantage of the available media and different means of information dissemination.
Monitoring and quantification of impact	MEMR and other stakeholders will monitor & evaluate the success of this initiative implementation. It is known that the evaluation process is not an easy task. But with the support of MEMR & distribution companies NERC may play a major role to do the necessary measurements before and after implementation of the measure, and also make the necessary comparison between electrical bills before & after implementation for some selected samples in different regions in Jordan.

A pilot project financed by JREEEF is already ongoing targeting about 10500 households (42000 LEDs) to test the distribution mechanism.

Distribution companies will procure the equipment from one or more suppliers of high-quality LED lamps in Jordan. All lamps will be guaranteed and shall be stamped with the distribution company logo to facilitate tracking. Delivery will be on a door-to-door basis using a one-stop approach involving a lighting audit combined with immediate installation of the replacement lamps. Participants will pay between 10% and 50% of the installed cost. JREEEF will support the remaining program costs.



2.1.2 MEASURE 2: Energy Label and Standard program for home appliances

Measures	Energy Label and standard program for home appliances
Objective	In accordance with the energy strategy and the Renewable Energy & Energy Efficiency Law to reduce energy consumption, the Government of Jordan represented by JSMO has taken concerted actions to enhance energy efficiency through the labeling and the certification of the households appliances.
Description of the measure	Energy label & minimum energy efficiency standards have been enforced and became mandatory in Jordan since 1/7/2014. Therefore, the need for efficient home appliances to replace inefficient appliances becomes crucial for Jordan to reduce the growing demand for electricity in residential sector. "Jordan is in an advantageous position to roll out the S&L program, with minimal domestic impact as most of the appliances sold in the Jordanian market are imported (~80%) and can adapt to new energy efficiency standards with relative ease". "However, local manufacturers will have to undertake certain changes in product design, assembly line configuration and supply chains. Additionally, local manufacturers will require support in terms of the availability of facilities for testing the energy efficiency ratings of their appliances. Research indicates that local manufacturers may require a suitable transition time (2-5 years depending on the type of appliance) to familiarize themselves with these changes" (*Home appliances Market Assessment, NERC & UNDP, 2012)*. "Primary research reveals wide variations in energy efficiency performance across the range of models available (when compared against the EU S&L standards) in the Jordanian market. Imported appliances sold by multinational brands are, in general, more energy efficient when compared with locally manufactured appliances". "For most imported products, the energy efficiency class varies between "C" to "A+++" whereas locally manufactured appliances can be categorized between "E" to 'A". If class "A" is considered to be the minimum energy performance standard (MEPS), most of the current locally-manufactured appliances in Jordan will not meet this requirement" (*Home appliances Market Assessment, NERC & UNDP, 2012)*.
Implementing agency	JSMO
Stakeholders involved	MEMR, EMRC, MIT, RSS/NERC, Local manufacturers, suppliers
Target group	Residential Sector
Program cost	NA
Cost / kWh saved	0.0169 JD/KWh (*Home appliances Market Assessment, NERC & UNDP, 2012)*.

Impacts of the program	It estimated that the project will lead to an annual savings of around 275 GWh with an annual increase in penetration rate of efficient appliances of more than 3% resulting in about 400 GWh savings by 2020. The program will save 21 million JD annually (30 M USD). The project will also lead to about 187 ktCO2 reduction, (*Home appliances Market Assessment, NERC & UNDP, 2012)*.
Source of funding	N/A
Financial instruments	N/A
Awareness	An awareness campaign should be initiated in the country addressing all stakeholders and target groups. The campaign should focus on the real benefit of purchasing efficient appliances for both consumers and the state.
Monitoring and quantification of impact	JSMO will take the responsibility of monitoring the implementation of the program in Jordan. It has already issued the needed technical Rules for different appliances as well as the necessary instruction for market surveillance. RSS/NERC has also started the installation of testing labs to support JSMO in identifying efficient appliances. These labs include Refrigerators lab, washing machines lab, Air conditioning lab and lighting lab.

2.1.3 MEASURE 3: Energy Efficiency building code enforcement in residential sector

Measure	Energy Efficiency building code enforcement in residential sector
Objective	The objective is to reduce energy consumption in new residential buildings by enforcing the new thermal insulation code, that will start late 2017.
Description of the measure	The Ministry of Public Works and Housing has been elaborating, several Building Codes, under the National Jordanian Building Law No.7 - 1993, out of which seven (7) are related to improving the energy performance of buildings: 1. Thermal Insulation Code 2. Updated Mechanical Ventilation and AC Code 3. Updated Central Heating Code 4. Updated Natural Ventilation Code --/2014 5. Updated Natural Lighting Code 6. Solar Energy Code 7. Energy Efficient Building Code The 2 last codes where adopted in 2014. However, the others codes will most probably be enforced in 2017, will allow reducing on the long term the energy consumption in buildings and improving the comfort of the habitants. The project aims to enhance and follow up on the enforcement of the energy efficiency building codes and particularly the **thermal insulation code.** Based on a rough estimation, the thermal insulation code will cover about 66000 new dwellings during the next 5 years.
Implementing agency	Jordan National Building Council (JNBC) under the Ministry of Public Works and Housing, Municipalities.
Stakeholders involved	Jordan National Building Council (JNBC), Municipalities, insulation material suppliers, construction enterprises, Jordan Engineers Association, Jordan Architects Association…
Target group	Residential Sector
Program cost	259 MJD (370 M$)
Cost / kWh saved	0.032JD/kWh (*0.046 $/kWh)*
Project impacts	The annual electricity saving is estimated to be around 401 GWh by 2020, 2/3 of that for heating and 1/3 for air conditioning. This will lead to total saving on the consumer bills of around 75 MJD. The project will also improve the comfort of the households by improving the temperature inside the building in summer and winter. In term of environment, the project will also lead to an emission

	reduction of about 188 $ktCO_2$ reduction.
Source of funding	Households, developers
Financial instruments	The incremental cost linked to the thermal insulation regulation is 3% to 10% of the total building cost depending on the socio-economic category of housing. This incremental cost can be absorbed by the construction market. According to the By-law No. (13) of 2015 which Exempts Renewable Energy & Energy Efficiency Equipment from the Customs Fees and Sales Tax, insulation material that will be used in the building to be compliant with the regulation is exempted from taxes.
Awareness	Although the building energy efficiency codes are obligatory, information and awareness on the new codes is highly required. Campaigns have to be directed to households, developers but also to banks, suppliers and construction companies.
Monitoring and quantification of impact	The monitoring will be insured mainly by the JNBC with the assistance of the Municipalities.

2.1.4 MEASURE 4: Roof insulation of existing buildings in residential sector

Measure	**Roof insulation of existing buildings in residential sector**
Objective	The stock of existing buildings is currently more than 2 million houses and apartments, constructed usually with low efficient. Hence the energy saving potential in this sector is huge. This initiative aims at reducing the energy consumption for heating and cooling in this buildings stock.
Description of the measure	The roof insulation is one of the simplest and more efficient measure to reduce energy consumption for space heating and cooling. if well implemented, It can reduce the energy consumption for heating and cooling by around 25% to 30%. The objective is to rollout a pilot program for the period 2018-2020 by applying massive implementation of a standard measure of roof insulation in existing residential building (1 and 2 floor houses). The program will target in the first phase around 15000 houses (one and 2 floor houses) with approximately a total space of 2 million m^2 of roof to be insulated. After evaluation, the program can be rolled out on larger scale.
Implementing agency	MEMR and particularly JREEEF
Stakeholders involved	JREEEF, Municipalities, insulation material suppliers, construction enterprises, Jordan Engineers Association, Banks.
Target group	Residential Sector (houses and 2 floors flats)
Program cost	32 MJD (46 M$)
Cost / kWh saved	0.039 JD/KWh (*0.056$/kWh)*

Impacts of the program	The annual electricity saving is estimated to be around 41 GWh by 2020, 2/3 of that from heating and 1/3 from air conditioning. Based on that the program will save around 7 MJD for the users per year by 2020. The project will also improve the comfort of the households by improving the temperature inside the building in summer and winter. The project will also lead to about 19 $ktCO_2$ reduction per year by 2020.
Source of funding	JREEEF, Households and banks
Financial instruments	The JREEEF can provide a partial subsidy to the households (20% to 30%) and the remaining part will be paid through bank loans using a specific credit line with soft condition. According to the By-law No. (13) of 2015 which Exempts Renewable Energy & Energy Efficiency Equipment from the Customs Fees and Sales Tax, insulation material that will be used in the building to be compliant with the regulation is exempted from taxes.
Awareness	The implementation of the project will require strong awareness campaigns, since the measure in rather new to Jordan and the market is still weak. The campaigns should target households but also banks and operation actors like suppliers and construction enterprises.
Monitoring and quantification of impact	MEMR (JREEEF) in cooperation with NERC should insure the monitoring and the evaluation of the project.

2.2 Commercial and Services Sector (6 Measures)

In tertiary sector, we distinguish mainly the public buildings and the commercial buildings. The following table presents the main information about the proposed measures.

Table 9: Summary of EE measures in commercial and Services sector

No	Measures	Description	Period	Electricity saving (GWh)	Program Cost (MJD)	Bill saving for users (MJD)
6	Jordan public building energy efficiency program	Government program of public building retrofitting	2015-2017	36	12	7
7	Replacement of Fluorescent Tubes in public buildings	80,000 of 10-watt Tube- LED Lamps	2017-2020	2	1	1
8	Energy efficiency in health centers	300 to 400 small and medium hospitals in all Jordan.	2017-2020	12	5	2
9	Replacement of Fluorescent Tubes in commercial buildings by LEDs	Replacement of 250.000 units of Fluorescent Tubes 4x18 watt with LED 60 cm Tubes.	2017-2020	66	15	10
10	Energy efficiency in existing small and medium hotels	100 to 120 small and medium hotels in all Jordan.	2017-2020	11	5	2
11	EE building codes enforcement in tertiary sector (Just insulation)	About 5700 new units during the next 5 years.	2017-2020	249	95	19
	Total			**376**	**133**	**41**

The total required investment to implement these measures is around 133 MJD (190 MUSD) and will allow saving for the households of about 41 MJD (58MUSD) per year by 2020. The CO_2 emission reduction will be around 176 ktCO_2 by 2020.

The individual measures are detailed hereafter.

2.2.1 MEASURE 5: Jordan public building energy efficiency program

Measure	Energy efficiency in existing public building
Objective	The program aims at improving the energy efficiency in existing public buildings, mainly hospitals, schools and administrative buildings.
Description of the measure	For this purpose, an agreement was signed between the Government of Jordan and KfW for a loan of 15 million euros. Buildings to be addressed include those under the responsibility of the Ministry of Public Works and Housing (MPWH), Ministry of Health and Ministry of Education (hospitals, schools and administrative buildings). The implementing agency is the MPWH and the project should be carried out for the period 2015-2017. The overall program objective is to contribute to climate protection and to reduce the budget constraints caused by high-energy costs of the Government of Jordan. For that, the program aims to increase the energy efficiency in public buildings, with an average reduction of energy consumption of the implemented technologies of at least 15% of the current consumption.
Implementing agency	Ministry of Public Works and Housing
Stakeholders involved	Ministry of Public Works and Housing, Ministry of Health, Ministry of Education
Target group	Public building (hospitals, schools and administrative buildings)
Program cost	12 MJD (15 M€ or 17 M$)
Cost / kWh saved	0.022 JD/kWh (*0.031$/kWh)*
Impacts of the program	The annual electricity saving is estimated to be around 36 GWh by 2020. Based on that, the program will save around 7 MJD per year for the government buildings by 2020. It is expected that the project will reduce the CO_2 emissions by around 15 $ktCO_2$ to 20 $ktCO_2$ per year by 2020.
Source of funding	Loan from KfW of 15 M€
Financial instruments	Public funding
Awareness	NA
Monitoring and quantification of impact	The Monitoring and Evaluation will be ensured by the MPWH with the help of the Ministries of Health and Education.

2.2.2 MEASURE 6: Replacement of Fluorescent Tubes in public buildings

Measures	**Replacement of 4x18 Fluorescent lamps with Light Emitting Diodes (LED) Tubes in Public Buildings**
Objective	This initiative aims at promoting Tube- Light Emitting Diodes (LED) lamps in public buildings.
Description of the measure	This measure intends to distribute 80,000 of 10-watt Tube- LED Lamps in Public Buildings. The LED lamps will replace the existing 4x18 watt fluorescent lamps. By distributing these lamps, it is estimated that

	energy savings will be more than 40% of the fluorescent lighting consumption. Every 18-watt fluorescent lamp will be replaced by 10 watt LED lamp.
Implementing agency	MEMR in cooperation with MPWH and sectorial Ministries will be in charge of the initiative and supervise the whole implementation of the program.
Stakeholders involved	MEMR, MPWH, sector Ministries and Public Institutions
Target group	Public Buildings
Total resource cost	1.2 MJD (1.7 MUSD).
Cost / kWh saved	It is estimated that the cost of each KWh saved will be around 0.008 JD/KWh (0.012 USD/KWh).
Impacts of the program	The electricity saving is estimated at around 2.4 GWh per year by 2020. This will lead to an annual reduction of CO_2 emission to around 1 $ktCO_2$, by the same year.
Source of funding	Public budget
Financial instruments	Public financing
Awareness	The implementation of this measure will be accompanied with an effective awareness campaign addressed to public institution employees.
Monitoring and quantification of impact	MEMR with the support of the target institutions will monitor & evaluate the success of this initiative implementation.

2.2.3 MEASURE 7: Energy efficiency in existing health centers

Measure	**Energy efficiency in existing heath centers**
Objective	The program to be initiated by JREEEF aims at improving energy efficiency in small and medium hospitals in Jordan (health centers), that will not be targeted by the KfW program focusing mainly on large hospitals.
Description of the measure	The program consists of financial and technical support to undertake appropriate energy efficiency measures in these small and medium hospitals. All energy efficiency measures can be eligible, including envelop insulation, improvement of air conditioning and heating equipment, efficient lighting, etc. The program can target 300 to 400 health center throughout Jordan and particularly remote areas.
Implementing agency	JREEEF
Stakeholders involved	Ministry of Health, Banks, Jordan Architects and Engineers Associations, Suppliers of EE equipments, etc.
Target group	Health sector
Program cost	5 MJD (7M$)
Total resource cost	NA
Cost / kWh saved	0.028 JD/KWh (*0.040$/kWh)*

Impacts of the program	The annual electricity saving is estimated to be around 12 GWh by 2020, which will allow a saving of around 2 MJD per year for the owners It is expected that the project will reduce around 5.6 $ktCO_2$ per year.
Source of funding	JREEEF, commercial banks, health sector
Financial instruments	JREEEF will use the grant, revolving credit and technical assistance windows for implementing projects in this sector. JREEEF may also utilize its guarantee window in this market.
Awareness	Information and awareness campaigns will be undertaking by JREEEF with the other partners prior to the launching of the program.
Monitoring and quantification of impact	The Monitoring and evaluation will be ensured by JREEEF in collaboration with the Ministry of Health.

2.2.4 MEASURE 8: Replacement of Fluorescent Tubes in commercial buildings by LEDs

Initiative	Replacement of 250.000 units of Fluorescent Tubes 4x18 watt with LED 60 cm Tubes.
Objective	The objective of the measure is to initiate the transformation of the lighting market towards more efficient technologies by encouraging the massive replacement of the fluorescent tubes by the LED in commercial sector.
Description of the measure	The replacement of the widespread fluorescent tubes (4x18) watt with LED Tubes is a very cost-effective EE measure that can be applied in commercial buildings. LED lamps (or tubes) consume more than 50% less electricity compared with its equivalent of fluorescent lamps. It is expected that this program will lead to contribute to marketing of around 1 million LED, 60 cm Lamps (4 x 250,000). Each unit of fluorescent tubes (4x18) watt will be replaced by 4x10 watt LED lamps.
Implementing agency	This initiative could be initiated by Jordan Chamber of Commerce with the support of MEMR & NERC as well as JREEEF.
Stakeholders involved	Chamber of commerce, Hotels Association, LED suppliers, etc.
Target group	Commercial building (Hotels, private office buildings, malls, etc.)
Program cost	The total cost of the program will be around 15 million JD (21 million USD) over the implementation period.
Cost / kWh saved	0.033 JD/KWh (0.048 USD/KWh)
Impacts of the program	The program will result in around 66 GWh reductions in energy consumption by 2020. The program will also lead to a reduction in the peak load demand of around 26 MW. The bill saving for the users is estimated to more than 10 MJD (15 MUSD) per year by 2020. The total emission reduction of CO_2 will be around 44 $ktCO_2$ by 2020.
Source of funding	The end users shall bear the whole cost of the LEDs replacement, so around 21 MJD. However, some soft cost might be needed to initiate/announce the program and for awareness campaign as

	well. This cost should be secured though Government or other grants available.
Financial instruments	The private sector target by these initiative can mix own financing with commercial bank financing. The measure is highly profitable and can be easily bankable. Also, it has to be reminded that LED lamps are already exempted from sales tax and custom duties.
Awareness	Awareness is key issue in this program. Large awareness campaigns should accompany the program and can be funded through the new EU technical assistance program to EE and RE in Jordan, that will start in 2017.
Monitoring and quantification of impact	An effective monitoring methodology should take place to assess the implementation of LED lamps and verify the resulted saving. In this case a survey could be carried out including performing actual measurement for a selected sample.

2.2.5 MEASURE 9: Energy efficiency in existing small and medium hotels

Measure	**Energy efficiency in existing small and medium hotels**
Objective	The program to be initiated by JREEEF aims at improving energy efficiency in small and medium existing hotels in Jordan.
Description of the measure	The owners of these hotels have limited internal funds to invest in EE projects and poor access to commercial financing and lack of knowledge and awareness of the available technologies. The program will consist of financial and technical support, combined with awareness and communication campaigns to undertake appropriate energy efficient measures in these categories of hotels. All energy efficiency measure can be eligible, including envelop insulation, improvement of air conditioning and heating equipment, efficient lighting, etc. The program can target 100 to 120 small and medium hotels throughout Jordan.
Implementing agency	JREEEF
Stakeholders involved	Ministry of Tourism, Hotels Association, Banks, Jordan Architects and Engineers Associations, Suppliers of EE equipments and materials, etc.
Target group	Tourism sector
Program cost	5 MJD (7M$)
Total resource cost	NA
Cost / kWh saved	0.032 JD/KWh (*0.045$/kWh)*
Impacts of the program	The annual electricity saving is estimated to be around 10.5 GWh by 2020, which will allow to save around 2 MJD per year for the owners and It is expected that the project will reduce CO_2 emissions by around 5 $ktCO_2$ per year by 2020.
Source of funding	JREEEF, Hotels, Commercial banks, donors
Financial instruments	JREEEF will use the grant, revolving credit and technical assistance

	windows for implementing projects in this sector. JREEEF may also utilize its guarantee window in this market.
Awareness	JREEEF in cooperation with the other stakeholders and Donors will undertake awareness and communication campaigns targeting small and medium hotels.
Monitoring and quantification of impact	The Monitoring and evaluation will be ensured by JREEEF in collaboration with the Hotels Association and the Ministry of Tourism.

2.2.6 MEASURE 10: Energy Efficiency building code enforcement in tertiary sector

Measure	**Energy Efficiency building code enforcement in tertiary sector**
Objective	The objective is to reduce energy consumption in new tertiary buildings by enforcing the energy efficiency codes, particularly the thermal insulation code, that will start in 2017.
Description of the measure	The project aims at enhancing and follow up on the enforcement of the energy efficiency building codes and particularly the thermal insulation code. Based on the survey on energy consumption in the service and commercial sector and according to rough estimation for the forecast of the number of new buildings, the thermal insulation code will concern about 5670 new buildings in this sector during the period 2016-2020 years, as following:
Implementing agency	Jordan National Building Council (JNBC) under the Ministry of Public Works and Housing, Municipalities and developers.
Stakeholders involved	Jordan National Building Council (JNBC), Municipalities, developers, insulation material suppliers, construction enterprises, Jordan Engineers Association, Jordan Architects Association…
Target group	Tertiary buildings including public and private sectors
Program cost	95 MJD (135 M$)
Total resource cost	NA
Cost / kWh saved	0.025JD/kWh (*0.036 $/kWh)*
Impacts of the program	The annual electricity saving is estimated at around 249 GWh by 2020, from which 80% from heating and 20% from air conditioning. This will lead to total saving on the consumer bills of around 19 MJD or 26 M$ per year, by 2020. The project will also improve the comfort of the users of the target buildings by improving the temperature inside the building in summer and winter.

	buildings	**m²**
Hotels	714	1 670 700
Hospitals and Clinics	388	246 000
Education	516	2 049 400
Offices	275	506 100
Total	**5667**	**4 472 200**

	The project will allow to reduce the emission of around 116 $ktCO_2$ in the sector.
Source of funding	Government for public buildings and private sector for private buildings, commercial banks
Financial instruments	Public and private financing and loans from commercial banks Energy Efficient Equipment, insulation material that will be used in the building to be compliant with the regulation is exempted from taxes.
Awareness	Although the building energy efficiency codes are obligatory, information and awareness on the new codes is highly required. Campaigns have to be directed to private developers but also to banks and operation actors like suppliers and construction enterprises.
Monitoring and quantification of impact	The monitoring will be insured mainly by the JNBC with the assistance of the Municipalities and the sector ministries.

2.3 MEASURE 11: Industrial sector (one Measure)

Industry is the second consumer of electricity in Jordan after the residential sector, with about 25% of the national consumption. According to the Energy Efficiency Scenario presented above, the industrial sector will ensure a reduction of about 14% of electricity consumption compared to the Business as Usual Scenario in 2020 and 28% by 2030.

The main measure that will be undertaken by Jordan during the next 5 years is to intensify energy audits and their implementation. The flowing table summarizes the main information on this measure.

Table 10: Summary of EE measures in industrial sector

No	Measures	Description	Period	Electricity saving (GWh)	Program Cost (MJD)	Bill saving for users (MJD)
11	EE program in industrial Sector	Energy Efficiency measures implementation 50 industries annually	2017-2020	383	105	53
	Total			**383**	**105**	**53**

The total cost of the program is estimated at 105 million JD (150 MUSD) and will allow to reduce the energy bill of the industry sector of about 53 million JD per year (75 MUSD) by 2020. The CO_2 emission reduction will be around 179 $ktCO_2$ per year by 2020. The details of this measure are presented as following:

Measure	**Energy Efficiency program in industrial Sector**
Objective	The objective of the measure is to reduce the electricity and fuel consumption in the industrial companies by improving their energy performances and align them to international standards. This will improve their competiveness while protect the environment.
Description of the measure	This program includes the following activities: 1. Carrying out detailed energy audits, by well skilled auditors 2. Defining energy efficiency improvement potential at audited

	industries and determine the most cost effective energy efficiency measures for improvement. Energy audits will be carried out through the following phases: - Walk-through visit to the factories. - Field visits to the factories under study for data collection on energy consumption and to determine the needed measuring instruments and staff to carry out the detailed audits. - Study and analysis of all measurements and findings. - Submit a detailed report which includes technical analysis, recommendations on energy and water saving measures in addition to investment/ financial analysis and indicators. 3. Based on the above, the factory will implement the recommended measures and monitor their implementation and results. There are some initiatives currently in progress: - SWITCH MED Project: the project will perform the followings: ✓ Perform Energy efficiency assessments for 20 industries which is being carried out by RSS/NERC funded by the EU through UNIDO. ✓ 12 industries out of the 20 assessments will be selected for carrying out detailed energy and environmental audit. - JREEEF also intends to finance energy audits and the implementation of energy efficiency measures for 50 industries annually. For this program, it is assumed that 30 energy audits & implementation will be performed per year up to 2020.
Implementing agency	JREEEF with the Chamber of Industry, Industries, Energy auditors, NERC, etc.
Stakeholders involved	Energy Auditors, ESCOs and Jordan Enterprise Development Corporation "JEDCO", Jordan Chamber of Industry and Chambers of Industry in other governorates.
Target group	Industrial companies
Program cost	It is estimated that the cost of the program will be around 105 MJD (150 MUSD)
Cost / kWh saved	Around 0.05 JD/kWh (0,08 $/KWh)
Impacts of the program	It is estimated that this program will lead to a saving of around 53 MJD by 2020 (75 MUSD). This will reduce the energy bill of the industries and make them more competitive. The CO_2 reduction from the program is estimated to 179 $ktCO_2$ by 2020.
Source of funding	JREEEF, Banking sector, Self-financing of industries
Financial instruments	Subsidy of Energy Audits from JREEEF, ESCOs & Commercial

	financing Exempts from customs and tax duties on energy efficiency and renewable energy equipment
Awareness	Awareness is key issue in this program. Large awareness campaigns to industries should accompany the program and can be funded through the new EU technical assistance program to EE and RE in Jordan that will start in 2017.
Monitoring and quantification of impact	A monitoring measurement & verification system of the implemented audits in the industries will set up and followed by JREEEF and NERC.

2.4 Water Pumping sector (11 Measures)

Because of Jordan topography, water pumping is a large consumer of electricity, with a consumption of around 2446 GWh in 2015. The pumping stations are rather old and for this reason the sector presents an important energy saving potential.

Since water pumping is considered one of the main electricity consumers in Jordan, the Water Authority (WAJ) in Jordan is doing its utmost to reduce energy consumption in pumping stations to become more energy efficient and cutting down its associated costs. Improving energy efficiency in pumping stations will reduce the burden on an already overstretched electricity generation sector, lowers the energy costs for WAJ while supporting climate change mitigation efforts through targeted investment and carbon efficient technology flows.

In the framework of the Jordan Water Strategy 2016-2025, The Ministry of Water and Irrigation published in 2016 the ‘’Water Sector Energy Policy’’, where two targets are fixed for 2025 : i) 15% reduction in the specific energy consumption of billed water corresponding to a 0.47 kg reduction of CO2 emissions for each billed cubic meter of water; and ii) Raise the share of renewable energy in power consumption to 10% corresponding to a total saving of 0.31 kg CO2 emissions per each billed cubic meter of water.

Water Authority is aware of the EE potential in the water sector and intends to implement an ambitious energy efficiency program summarized in the 11 projects by 2020 as following:

Table 11: Summary of EE measures in water pumping sector (11 projects)

No	Measures	Period	Electricity saving (GWh)	Program Cost (MJD)	Bill saving for users (MJD)	Co2 emission ktoe period	Co2 emission ktoe/yr
1	EE for Wala-Lib pump operations outsourcing	2015-2020	3.6	0.6	0.3	10.0	2.5
2	WWTP Wadi Shalala	2017-2020	3.5	45.0	0.3	9.8	40.0
3	Energy Efficiency Program I	2018-2020	34.8	25.6	3.3	73.2	24.4
4	WWTP Irbid Central+ Wadi Arab Digesters	2019-2020	57.1	11.3	5.4	80.0	40.0
5	Energy Efficiency Program II	2020	11.8	19.5	1.1	8.3	8.3
6	Improving EE in water supply/ Regular energy Audits	2018-2020	4.0	2.3	0.4	8.4	2.8

7	Aqeb Conveyor Project/ Gravity supply Mafraq area	2018-2020	5.6	2.3	0.5	11.7	3.9
8	EE for Baqorieh pumping station	2015-2020	1.5	0.6	0.1	4.4	1.1
9	EE at Zarqa Governorate pumping stations	2013-2018	8.7	12.0	0.8	10.8	5.4
10	Replacement of 25 pumps for Zara Ma'en pumping stations	2019-2020	14.9	16.3	1.4	21.4	10.7
11	EE at Zai pumping station	2018-2020	17.7	5.6	1.7	37.0	12.4
	Total		**163**	**141**	**15.3**	**275**	**151**

The total investment of the program mounts to 141 million JD (201 MUSD) and will allow an important energy bill saving of about 15.3 million JD (21.6 MUSD) by 2020. The total emission reduction of CO_2 will be around 275 $ktCO_2$ by the year 2020. The details of this program are presented hereafter:

2.4.1 MEASURE 12: EE program at Wala-Libb pump operations outsourcing

Measure	Program of cost savings due to energy efficiency
Objective	Reducing energy consumption in pumping stations to become more energy efficient and cutting down its associated costs. Improving energy efficiency in pumping stations will reduce the burden on an already overstretched electricity generation sector, lowers the energy costs for Water sector while supporting climate change mitigation efforts through targeted investment and carbon efficient technology flows
Description of the measure	Installation of new pumps and operation of Wala-Libb PS on performance based contract.
Implementing agency	MoWI
Stakeholders involved	Miyahuna, WAJ
Target group	Water pumping sector
kWh saved	3,600,000 kWh
Project cost	580,000 JD
Cost / kWh saved	0.161 JD/kWh
Impacts of the program	The EE project will help to reduce the Water Authority of Jordan's costs by almost (338400) JD per year. The reduction in term of CO_2 emission will be around 10 $ktCO_2$ by 2020 (2.5 $ktCO_2$ per year)
Source of funding	GIZ/ EBRD
Financial instruments	budget support

Awareness	The target group in this program is the implementing organization. Therefore, good planning of program implementation has led to significant results. In addition, the donors have been made aware about the topic "Energy Efficiency in Water Sector" is proving a stronger focus on this topic, which means also more funds.
Monitoring and quantification of impact	The projects will be monitored and evaluated jointly by Jordan Water Authority and donors on operational level. The quantification of the impact is relatively easy, since the differences in electricity consumption can in most cases be easily measured through the new equipment.
Year of Enforcement	2015-2020
Remarks	Ongoing contract

2.4.2 MEASURE 13: EE program for cost savings: WWTP Wadi Shalala

Measure	Program of cost savings due to energy efficiency
Objective	Reducing energy consumption in WWTP Wadi Shalala to become more energy efficient and cutting down its associated costs. Improving energy efficiency in WWTP Wadi Shalala will reduce the burden on an already overstretched electricity generation sector, lowers the energy costs for water sector while supporting climate change mitigation efforts through targeted investment and carbon efficient technology flows
Description of the measure	Combined heat and power plants (CHP plant) 500 kW to utilize digester gas, capacity factor 80%
Implementing agency	MoWI
Stakeholders involved	WAJ & water companies
Target group	Water sector
kWh saved	3,504,000 kWh
Program cost	60,000,000 Euros (45,000,000 JD)
Cost / kWh saved	12.84 JD/kWh
Impacts of the program	The EE project will help to reduce the Water Authority of Jordan's costs by almost 329376 JD per year. The reduction in term of CO_2 emission will be around 9.8 $ktCO_2$ by 2020 (2.45 $ktCO_2$ per year)
Source of funding	KfW+ Water sector
Financial instruments	funds & budget support

Awareness	The target group in this program is the implementing organization. Therefore, good planning of program implementation has led to significant results. In addition, the donors have been made aware about the topic "Energy Efficiency in Water Sector" is proving a stronger focus on this topic, which means also more funds.
Monitoring and quantification of impact	The projects will be monitored and evaluated jointly by Jordan Water Authority and donors on operational level. The quantification of the impact is relatively easy, since the differences in electricity consumption can in most cases be easily measured through the new equipment.
Year of Enforcement	2017-2020
Remarks	Start of operation August 2016

2.4.3 MEASURE 14: Energy Efficiency Program I

Measures	Program of cost savings due to energy efficiency
Objective	Reducing energy consumption in pumping stations to become more energy efficient and cutting down its associated costs. Improving energy efficiency in pumping stations will reduce the burden on an already overstretched electricity generation sector, lowers the energy costs for WAJ while supporting climate change mitigation efforts through targeted investment and carbon efficient technology flows
Description of the measure	Replacement of pumps & rehabilitation of 79 wells
Implementing agency	MWI
Stakeholders involved	WAJ & water companies
Target group	WAJ, Yarmouk & Miyahuna
kWh saved	34,819,288
Program cost	25.6 MJD
Cost / kWh saved	0.595 JD/kWh
Impacts of the program	The EE project will help to reduce the Water Authority of Jordan's costs by almost 3.27 million JD per year. The reduction in term of CO_2 emission will be around 73.2 $ktCO_2$ by 2020 (24.4 $ktCO_2$ per year)
Source of funding	KfW +Budget Support
Financial instruments	Loans funds & budget support

Awareness	The target group in this program is the implementing organization. Therefore, good planning of program implementation has led to significant results. In addition, the donors have been made aware about the topic "Energy Efficiency in Water Sector" is proving a stronger focus on this topic, which means also more funds.
Monitoring and quantification of impact	The projects will be monitored and evaluated jointly by Jordan Water Authority and donors on operational level. The quantification of the impact is relatively easy, since the differences in electricity consumption can in most cases be easily measured through the new equipment.
Year of Enforcement	2018-2020
Remarks	Contract awarded

2.4.4 MEASURE 15 : EE program at WWTP Irbid Central and Wadi Arab Digesters

Measures	Program of cost savings due to energy efficiency
Objective	Reducing energy consumption in WWTP Irbid Central and Wadi Arab Digesters to become more energy efficient and cutting down its associated costs. Improving energy efficiency will reduce the burden on an already overstretched electricity generation sector, lowers the energy costs for WAJ while supporting climate change mitigation efforts through targeted investment and carbon efficient technology flows
Description of the measure	Introduction anaerobic sludge stabilization + CHO, Energy saving Central Irbid 22.65 GWh/year, Wadi Arab 34.43 GWh/year
Implementing agency	MWI
Stakeholders involved	WAJ & water companies
Target group	Water sector
kWh saved	57,080,000 kWh
Program cost	15,000,000 Euro (11,250,000 JD)
Cost / kWh saved	0.197 JD/kWh
Impacts of the program	The EE project will help to reduce the Water Authority of Jordan's costs by almost 5.37million JD per year. The reduction in term of CO_2 emission will be around 80 $ktCO_2$ by 2020 (40 $ktCO_2$ per year)
Source of funding	KfW
Financial instruments	Loans, funds & budget support

Awareness	The target group in this program is the implementing organization. Therefore, good planning of program implementation has led to significant results. In addition, the donors have been made aware about the topic "Energy Efficiency in Water Sector" is proving a stronger focus on this topic, which means also more funds.
Monitoring and quantification of impact	The projects will be monitored and evaluated jointly by Jordan Water Authority and donors on operational level. The quantification of the impact is relatively easy, since the differences in electricity consumption can in most cases be easily measured through the new equipment.
Year of Enforcement	2019-2020
Remarks	Consulting services tendered

2.4.5 MEASURE 16 : Energy Efficiency program II

Measures	Program of cost savings due to energy efficiency
Objective	Reducing energy consumption by elimination of pumping to become more energy efficient and cutting down its associated costs. Improving energy efficiency by elimination of pumping stations will reduce the burden on an already overstretched electricity generation sector, lowers the energy costs for water sector while supporting climate change mitigation efforts through targeted investment and carbon efficient technology flows
Description of the measure	Gravity supply switch in Madaba with elimination of pumping stations
Implementing agency	MWI
Stakeholders involved	WAJ & water companies
Target group	Water sector
kWh saved	11,786,432 kWh
Program cost	26,000,000 Euro (19,500,000 JD)
Cost / kWh saved	1.654 JD/kWh
Impacts of the program	The EE project will help to reduce the Water sector of Jordan's costs by almost (1.11) million JD per year. The reduction in term of CO_2 emission will be around 8.25 $ktCO_2$ by 2020 (8.25 $ktCO_2$ per year)
Source of funding	KfW
Financial instruments	Loans, funds & budget support

Awareness	The target group in this program is the implementing organization. Therefore, good planning of program implementation has led to significant results. In addition, the donors have been made aware about the topic "Energy Efficiency in Water Sector" is proving a stronger focus on this topic, which means also more funds.
Monitoring and quantification of impact	The projects will be monitored and evaluated jointly by Jordan Water Authority and donors on operational level. The quantification of the impact is relatively easy, since the differences in electricity consumption can in most cases be easily measured through the new equipment.
Year of Enforcement	2020
Remarks	24 M Euro KfW share (to be confirmed)

2.4.6 MEASURE 17 : EE program for cost savings: Introduction of regular energy audits

Measures	Program of cost savings due to energy efficiency
Objective	Reducing energy consumption in pumping stations to become more energy efficient and cutting down its associated costs. Improving energy efficiency in pumping stations will reduce the burden on an already overstretched electricity generation sector, lowers the energy costs for WAJ while supporting climate change mitigation efforts through targeted investment and carbon efficient technology flows
Description of the measure	Introduction of regular energy audits
Implementing agency	MWI
Stakeholders involved	WAJ & water companies
Target group	Water sector
kWh saved	4,000,000
Program cost	3,000,000 Euro (2,250,000 million JD)
Cost / kWh saved	0.563 JD/kWh
Impacts of the program	The EE project will help to reduce the Water Authority of Jordan's costs by almost (376,000) JD per year. The reduction in term of CO_2 emission will be around 5.6 $ktCO_2$ by 2020 (2.8 $ktCO_2$ per year)
Source of funding	GIZ
Financial instruments	Loans, funds & budget support
Awareness	The target group in this program is the implementing organization.

	Therefore, good planning of program implementation has led to significant results. In addition, the donors have been made aware about the topic "Energy Efficiency in Water Sector" is proving a stronger focus on this topic, which means also more funds.
Monitoring and quantification of impact	The projects will be monitored and evaluated jointly by Jordan Water Authority and donors on operational level. The quantification of the impact is relatively easy, since the differences in electricity consumption can in most cases be easily measured through the new equipment.
Year of Enforcement	2018-2020

2.4.7 MEASURE 18: Aqeb Conveyor Project/ Gravity Supply Mafraq from upper Aqeb

Measures	Gravity Supply Mafraq Area – Reduction of Energy Consumption
Objective	Reducing energy consumption by Supply part of Mafraq city plus surrounding villages by gravity from upper Aqeb wells, stop old Za'atary pumping to become more energy efficient and cutting down its associated costs. Improving energy efficiency will reduce the burden on an already overstretched electricity generation sector, lowers the energy costs for WAJ while supporting climate change mitigation efforts through targeted investment and carbon efficient technology flows
Description of the measure	Supply part of Mafraq city plus surrounding villages by gravity from upper Aqeb wells, stop old Za'atary pumping station
Implementing agency	MWI
Stakeholders involved	WAJ & water companies
Target group	Water sector
kWh saved	5,571,360 kWh
Program cost	3,000,000 Euro (2,250,000 million JD)
Cost / kWh saved	0.404 JD/kWh
Impacts of the program	The EE project will help to reduce the Water Authority of Jordan's costs by almost 523,707 JD per year. The reduction in term of CO_2 emission will be around 11.7 $ktCO_2$ by 2020 (3.9 $ktCO_2$ per year)
Source of funding	KfW
Financial instruments	Loans, funds & budget support
Awareness	The target group in this program is the implementing organization. Therefore, good planning of program implementation has led to

	significant results. In addition, the donors have been made aware about the topic "Energy Efficiency in Water Sector" is proving a stronger focus on this topic, which means also more funds.
Monitoring and quantification of impact	The projects will be monitored and evaluated jointly by Jordan Water Authority and donors on operational level. The quantification of the impact is relatively easy, since the differences in electricity consumption can in most cases be easily measured through the new equipment.
Year of Enforcement	2018-2020
Remarks	Design ongoing construction in 2017

2.4.8 MEASURE 19: EE program for cost savings at Baqorieh pumping station

Measures	Program of cost savings due to energy efficiency
Objective	Reducing energy consumption in pumping stations to become more energy efficient and cutting down its associated costs. Improving energy efficiency in pumping stations will reduce the burden on an already overstretched electricity generation sector, lowers the energy costs for WAJ while supporting climate change mitigation efforts through targeted investment and carbon efficient technology flows
Description of the measure	EE for Baqorieh pumping station (pilot project)
Implementing agency	Water Authority of Jordan
Stakeholders involved	WAJ
Target group	Water pumping sector
kWh saved	1,500,000 kWh
Program cost	600,000 JD
Cost / kWh saved	0.4 JD/kWh
Impacts of the program	The EE project will help to reduce the Water Authority of Jordan's costs by almost 141,000 JD per year. The reduction in term of CO_2 emission will be around 4.4 $ktCO_2$ by 2020 (1.1 $ktCO_2$ per year)
Source of funding	KfW
Financial instruments	Loans, funds & budget support
Awareness	The target group in this program is the implementing organization. Therefore, good planning of program implementation has led to significant results. In addition, the donors have been made aware about

	the topic "Energy Efficiency in Water Sector" is proving a stronger focus on this topic, which means also more funds.
Monitoring and quantification of impact	The projects will be monitored and evaluated jointly by Jordan Water Authority and donors on operational level. The quantification of the impact is relatively easy, since the differences in electricity consumption can in most cases be easily measured through the new equipment.
Year of Enforcement	2017 -2020 (started in 2015)
Remarks	Pilot project

2.4.9 MEASURE 20: EE program at Zarqa Governorate pumping stations

Measure	Program of cost savings due to energy efficiency
Objective	Reducing energy consumption in pumping stations to become more energy efficient and cutting down its associated costs. Improving energy efficiency in pumping stations will reduce the burden on an already overstretched electricity generation sector, lowers the energy costs for WAJ while supporting climate change mitigation efforts through targeted investment and carbon efficient technology flows.
Description of the measure	EE at Zarqa Governorate pumping stations
Implementing agency	Water Authority of Jordan
Stakeholders involved	Miyahuna
Target group	Water pumping sector
kWh saved	8,690,000 kWh
Program cost	12,000,000 JD
Cost / kWh saved	1.381 JD/kWh
Impacts of the program	The EE project will help to reduce the Water Authority of Jordan's costs by almost 816,860 JD per year. The reduction in term of CO_2 emission will be around 10.8 $ktCO_2$ by 2020 (5.4 $ktCO_2$/year)
Source of funding	JICA & public funding
Financial instruments	funds & budget support
Awareness	The target group in this program is the implementing organization. Therefore, good planning of program implementation has led to significant results. In addition, the donors have been made aware about the topic "Energy Efficiency in Water Sector" is proving a stronger focus on this topic, which means also more funds.

Monitoring and quantification of impact	The projects will be monitored and evaluated jointly by Jordan Water Authority and donors on operational level. The quantification of the impact is relatively easy, since the differences in electricity consumption can in most cases be easily measured through the new equipment.
Year of Enforcement	2013-2018

2.4.10 MEASURE 21: Replacement of 25 pumps for Zara Ma'en pumping stations

Measures	Program of cost savings due to energy efficiency
Objective	Reducing energy consumption in pumping stations to become more energy efficient and cutting down its associated costs. Improving energy efficiency in pumping stations will reduce the burden on an already overstretched electricity generation sector, lowers the energy costs for WAJ while supporting climate change mitigation efforts through targeted investment and carbon efficient technology flows.
Description measure	EE at Zara Ma'en pumping stations/ Replacement of 25 pumps
Implementing agency	Water Authority of Jordan
Stakeholders involved	WAJ + Miyahuna
Target group	Water pumping sector
kWh saved	14,893,617 kWh
Program cost	(23,000,000 US$) 16,307,000 JD
Cost / kWh saved	1.095 JD/kWh
Impacts of the program	The EE project will help to reduce the Water Authority of Jordan's costs by almost 1,400,000 JD per year. The reduction in term of CO_2 emission will be around 21.4 $ktCO_2$ by 2020 (10.7 $ktCO_2$ /year)
Source of funding	USAID
Financial instruments	Grant
Awareness	The target group in this program is the implementing organization. Therefore, good planning of program implementation has led to significant results. In addition, the donors have been made aware about the topic "Energy Efficiency in Water Sector" is proving a stronger focus on this topic, which means also more funds.
Monitoring and quantification of impact	The projects will be monitored and evaluated jointly by Jordan Water Authority and donors on operational level. The quantification of the impact is relatively easy, since the differences in electricity consumption can in most cases be easily measured through the new equipment.
Year of Enforcement	2019-2020

2.4.11 MEASURE 22: EE program for cost savings at Zai pumping station

Measures	Program of cost savings due to energy efficiency
Objective	Reducing energy consumption in pumping stations to become more energy efficient and cutting down its associated costs. Improving energy efficiency in pumping stations will reduce the burden on an already overstretched electricity generation sector, lowers the energy costs for WAJ while supporting climate change mitigation efforts through targeted investment and carbon efficient technology flows.
Description of the measure	EE at Zai pumping station
Implementing agency	Water Authority of Jordan
Stakeholders involved	Water Authority of Jordan
Target group	Water sector
kWh saved	17,661,962 kWh
Program cost	(880,000,000 YEN) 5,605,600 JD
Cost / kWh saved	0.317 JD/kWh
Impacts of the program	The EE project will help to reduce the Water Authority of Jordan's costs by almost 1.66 milion JD per year. The reduction in term of CO_2 emission will be around 37 $ktCO_2$ by 2020 (12.36 $ktCO_2$/year)
Source of funding	Searching for fund
Financial instruments	No fund
Awareness	The target group in this program is the implementing organization. Therefore, good planning of program implementation has led to significant results. In addition, the donors have been made aware about the topic “Energy Efficiency in Water Sector” is proving a stronger focus on this topic, which means also more funds.
Monitoring and quantification of impact	The projects will be monitored and evaluated jointly by Jordan Water Authority and donors on operational level. The quantification of the impact is relatively easy, since the differences in electricity consumption can in most cases be easily measured through the new equipment.
Year of Enforcement	2018-2020

2.5 MEASURE 23: Street lighting (one Measure)

Jordan has more than 330,000 street lighting points that has consumed around 337 GWh in 2015. The energy efficiency in the sector is very important for Municipalities, for which lighting is the major part of their expenses. The 125-Watt Mercury lamps represents 40% of the total stock, around 132000 Lamps. The proposed measure consists mainly of the replacement of all the 125-Watt Mercury lamps by efficient LED lamps and use automatic street lighting controls and voltage regulators to improve the operation of the street lighting system.

The main information is presented in the following table.

Table 12: Summary of EE measures in street lighting

No	Measures	Description	Period	Electricity saving (GWh)	Program Cost (MJD)	Bill saving for users (MJD)
23	Replacement of Mercury lamps by efficient lamps and use Automatic street lighting controls and voltage regulators	The project includes a replacement of 230,137 units of mercury lamps of 125 watt with 70-watt high pressure sodium.	2017-2020	55	11	4
	Total			**55**	**11**	**4**

For a total investment cost of around 11 million JD (15 MUSD), the program will allow an energy saving of 55 GWh per year by 2020 which will save around 4 million JD (5.6 MUSD) per year for the Municipalities and reduce the CO_2 emission by 26 $ktCO_2$.

The details of this program are presented as following:

Measure	**Replacement of mercury lamps by efficient LED lamps and use of automatic street lighting controls and voltage regulators**
Objective	The objective is to reduce energy consumption in street lighting and accordingly reduce its costs for Municipalities. This will encourage and motivate Municipalities to focus more on improving their services to their communities by utilizing the savings coming from improving EE in street lighting.
Description of the measure	The project includes a replacement of 132000 units of mercury lamps of 125watt with 30-watt LED. The project might also be enhanced by the installation of voltage control devices for dimming purposes in certain times and installation of astronomic switch to control switching on & off of the lights.
Implementing agency	Ministry of Municipalities, all Municipalities.
Stakeholders involved	Municipalities, Ministry of Municipalities, electricity distribution companies, Suppliers of LEDs…
Target group	Municipalities
Program cost	The total cost is estimated to 11 MJD (15 MSUD)
Cost / kWh saved	0.06 JD/KWh (0.09 $/kWh)
Impacts of the program	The program will allow electricity saving of about 55 GWh by 2020 and a reduction of 13 MW of load demand during the peak hours at

	night. The annual energy bill reduction of the municipalities is estimated to about 4 MJD by 2020. Finally the emission reduction of CO_2 is estimated at 26 ktCO_2 per year by 2020.
Source of funding	Municipalities and multi donors
Financial instruments	Public funding Tax Exemption for efficient lighting.
Awareness	Awareness of municipalities will be carried out through various channels: - The Ministry of Municipalities - The SEAPs that will be developed within the CESMED EU project in three Municipalities in the country - The new EU technical assistance program to EE and RE in Jordan, that will start in 2017.
Monitoring and quantification of impact	Monitoring & Evaluation will be the responsibility of Municipalities and electricity distribution companies.

2.6 Municipal Level

MINARET Project

In the framework of the MINARET project ("The MENA Region Initiative as a model of NEXUS: Approach and Renewable Energy Technologies (MINARET)"), the Municipality of Al-Karak will implement two energy efficiency measures to improve the energy performance and reduce its energy consumptions of the Municipality Buildings and of the street lighting for Al-Karak Municipality.

Table: Summary of EE measures in the Municipalities

No	Measures	Period	Electricity saving (GWh)	Program Cost (MJD)	Bill saving for users (MJD)
24	Improve the energy performance of Al-Karak municipality Buildings to reduce energy consumption and its associated costs.	2017-2020	0.8	0.08	0.160
25	Reduce the consumption of street lighting for Al-Karak Municipality.	2017-2020	0.055	0.03	0.065
	Total		**0.9**	**0.11**	**0.225**

For a total investment cost of around 110 000 JD the program will allow an energy saving of 855 MWh per year by 2020 which will save around 225 000 JD per year for the Al Karak Municipality.

The details of this program are presented as following:

2.6.1 MEASURE 24: Energy Efficiency in the Al-KARAK Municipality Buildings building

Measures	"The MENA Region Initiative as a model of NEXUS Approach and Renewable Energy Technologies (MINARET)"- (EE in Al-Karak Municipality Buildings)
Objective	Improve the energy performance of Al-Karak municipality Buildings to reduce energy consumption and its associated costs.
Description of the measure	This measure will include several actions including lighting systems, cooling & heating, insulation and office equipment. It is expected that this measure will realize an electricity savings of around 800 MWh per year with a total cost savings of around JD 160,000 per year.
Implementing agency	Royal Scientific Society/National Energy Research Center
Stakeholders involved	EDCO, IUCN and FPEC
Target group	Karak Municipality, local community
Program cost	80,000 JD
Cost / kWh saved	0.014 JD/Kwh saved
Impacts of the program	It is estimated to save up to 800 MWh/year and avoiding around 480 tone of CO2 emission. Moreover, it will reduce the load demand by 250 KW.
Source of funding	Sweden International Development Agency (SIDA).
Financial instruments	In term of incentive, the Government of Jordan has exempted all energy efficiency and renewable energy equipment including LEDs from custom duties and sales tax according to the By-Law of Exempting Renewable Energy & Energy Efficiency Equipment, which led to a significant reduction in their market prices for the end user.
Awareness	The MINARET project will include an awareness program to the Municipality officers and the Local community.
Monitoring and quantification of impact	This measure will be monitored by the MINARET project.

2.6.2 MEASURE 25: Reduce the consumption of street lighting for Al-Karak Municipality

Measures	The MENA Region Initiative as a model of NEXUS approach and Renewable Energy Technologies (MINARET)"- (Street lighting in Al-Karak Municipality)
Objective	Reduce the consumption of street lighting for Al-Karak Municipality.
Description of the measure	This measure will include replacement of up to 180 street lighting Units-125-watt Mercury with energy efficient units (LED Lighting). It is expected that this measure will realize an electricity savings of around 55 MWh per year with a total cost savings of around JD 6500 per year.
Implementing agency	Royal Scientific Society/National Energy Research Center
Stakeholders involved	EDCO, IUCN and FPEC
Target group	Karak Municipality, local community
Program cost	30,000 JD
Cost / kWh saved	0.078 JD/Kwh saved
Impacts of the program	It is estimated to save up to 55 MWh/year and avoiding around 33 tons of CO2 emission. Moreover, it will reduce the load demand by 13 KW.
Source of funding	Sweden International Development Agency (SIDA).
Financial instruments	In term of incentive, the Government of Jordan has exempted all energy efficiency and renewable energy equipment including LEDs from custom duties and sales tax according to the By-Law of Exempting Renewable Energy & Energy Efficiency Equipment, which led to a significant reduction in their market prices for the end user.
Awareness	The MINARET project will include an awareness program to the Municipality officers and the Local community.
Monitoring and quantification of impact	This measure will be monitored by the MINARET project.

2.7 MEASURE 26: Transport Sector

The transport sector was not included in the first NEEAP as it focused only on electricity savings due to the fact that is was based on the Arab EE guideline and other reasons that will not be addressed in this document.

With the transport sector being the biggest energy consumer in Jordan when it comes to the final energy consumption, The REEEII-TA project is working closely with the Ministry of Energy and Mineral Resources to bridge this gap through dedicated strtegy and action plan for this important sector.

In this regards, The Ministry of Energy and Mineral Resources in coordination with REEEII-TA in coordination wio organized a national consultation with all the national stakeholders not only to discuss the second NEEAP project , but also to address the missing elements and

pillars as part of the continuous and never-ending process of the Energy Efficiency Adoption among Jordanian Sectors.

The consultation meeting came up with important recommendations to establish a working group headed by the Ministry of Transport for that will assist MEMR / JREEEF to develop the needed energy effeciency in the transport sector strategies and plans with focus on:

- Developing a detailed action plan for the potential EE projects.
- Performing Carbon Reduction Studies for the highest consumptions areas.
- Developing Master EE Strategy for the whole sector to facilitate funds extraction.
- Implementing Pilot EE projects.
- Developing a transformation plan (hybrid & Electric vehicle replacements). Developing transportation routes master plan to reduce the emissions.

In addition to this progress, the MEMR had developed, as described above in Part 2 of this document a Long term Energy Efficiency scenarios in Jordan including the **transport sector** in the both the business as usual and the EE scenarios. Results of booth scenarios show that the transport sector will remain the main energy consuming sector with a share of about 52% (54% for the EES) in 2030 in comparison to 48% of final energy consumption in 2015. In the EES, hybrid and electrical cars introduction were considered in the hypothesis and it will reach 90000 vehicles by 2020. Also, the forecast has taken into account the introduction of electrical Railway transport for freight from Aqaba to Amman (after 2020) as it was stipulated in the existing transport strategy. For electricity, the transport sector is consuming more electricity which will reach a share of 10% of the total electricity consumption in 2030 in the case of the EES**.** The transport sector will show an important saving on the long term, with the introduction of the train transport after 2025 (14% in 2030).

Transport sector, Final Energy consumption according to BAU and EES (ktoe)

Sector	2014	2020			2030		
		BaUS	EES	Saving	BaUS	EES	Saving
Transport	2684	3552	3372	-5%	5332	4610	-14%

Regarding the electricity consumption in the transport sector in 2030, it is estimated to 3729 GWh according to the EES and only 1397 GWh in the BaU case. Despite the development of the use of electrical cars and electrified railway transport, the electricity savings due to the EES is expected to double from 6% by 2020 to 13% by 2030.

3 Cross-sectorial measures (8 Measures)

In addition to the above sectorial measures, some cross-cutting ones enabling measures will be undertaken under the NEEAP and will help to reach the target. The following table summarizes the most important horizontal measures.

Table 13: Summary of main cross-cutting measures

No	Measures	Implementation period
27	RE & EE Custom Duties and Sale Taxes exemption	On-going since 2014 & updated in 2015
28	Jordan RE & EE Fund (JREEEF)	Since May 2015
29	EE Buildings Codes (7 codes)	-2 of them adopted in 2014 - All to be enforced starting in 2017
30	EC- RE&EE Program in Jordan (REEE II)	2017-2020
31	MINARET Project	2017-2020
32	CES-MED Project	2010-2017
33	SUDEP/ SAHAB project	2015-2017
34	National Green Growth Plan	according the GGGI Jordan

3.1 MEASURE 27: RE&EE equipment exemption from Custom Duties & Sale Taxes

Measure	**RE &EE equipment exemption from Custom Duties and Sale Taxes**
Objective	To enhance market transformation towards renewable energies and efficient equipments.
Description of the measure	This measure, issued according to the By-Law 10 of 2013 and updated by the By-Law N° 13 of 2015, gives a total exemption from custom duties and sale taxes for RE and EE equipments and devices imported or produced locally in order to promote the investment in these sectors. The eligible RE and EE equipments are mentioned in the annexes of the By-Law and can be updated under proposal of the Committee of Custom Duties and Sale Taxes Exemption created by the same By-Law.
Implementing agency	MEMR, Custom Department, Sales Tax Department.
Stakeholders involved	The Committee of Custom Duties and Sale Taxes Exemption mentioned above includes representatives from the main concerned public administration: MEMR, Ministry of Environment, Ministry of Industry and Commerce, Department of Custom and Department of Sale Taxes.
Target group	Energy consumers
Impacts of the program	This measure is supposed to reduce the final cost of EE & RE equipments for the end users and therefore will lead to increase the market share of efficient equipments. Subsequently, this will have a positive impacts in term of energy saving and CO_2 emission reduction.
Source of funding	Public budget
Financial instruments	This measure is a kind of financial instrument that reduce the cost

	of EE projects to the users.
Awareness	This decision of the Government was widely announced and communicated to all concerned stakeholders.
Monitoring and quantification of impact	MEMR, through, a technical committee will follow the implementation of this decision and its impacts.

3.2 MEASURE 28: The Jordan Renewable Energy&Energy Efficiency Funds (JREEEF)

Measure	**Jordan Renewable Energy and Energy Efficiency Fund (JREEEF)**
Objective	Increase the use of RE & EE technologies by providing the necessary tailored financing to RE and RE projects and programs.
Description of the measure	Jordan Renewable Energy & Energy Efficiency Fund (JREEEF) is created in 2012 by the EE and RE Law N°13 (articles 12, 13, 14, 15 and 16). But it became operational in 2015 after the promulgation of the By-Law N° 49 of 2015. The Fund is established within the MEMR with the aim of providing the necessary funding for energy efficiency and renewable energy measures at end-users' level. It supports any program and financial mechanism allowing RE and EE users to access to financing from banks, local and international financial institutions. This includes loan interest rate subsidy, revolting funds, financial risk mitigation, credit guarantees, equity participation, subsidy to investment in innovating projects and soft investment such as, energy audits, feasibility studies, and public awareness campaigns.
Implementing agency	Ministry of Energy and Mineral Resources
Stakeholders involved	JREEEF, banks, donors
Target group	Private sector, public sector, households, etc.
Impacts of the program	By offering large panoply of financing instrument, the JREEEF may help a lot to remove the bottleneck of EE projects financing in Jordan. It will also have a leverage effect by mobilizing financing from the conventional financial sector to EE. The EE market revitalization will lead, at macro level, to energy saving and CO_2 emission reduction.
Source of funding	Public budget, Donors, Banks…
Financial instruments	The financial instruments used by JREEEF are: · Loan interest rate subsidy · Revolting fund · Equity participation · Risk mitigation and credit guarantees · Subsidy to soft investment and innovating projects (energy audits, feasibility studies, public information and awareness campaigns, etc.)
Awareness	JREEEF will intensify awareness among the target sectors in order to promote EE projects financing.
Monitoring and quantification of impact	The Fund will be followed by a Management Committee under the Chairmanship of the Minister and the membership of: · Secretary General of the Ministry as Vice-Chairman. · Two representatives of the public sector from relevant entities specified by the Minister · Three representatives of the private sector with appropriate expertise and competence named by the Minister

The following table presents a summary of the action plan of the JREEEF up to 2020, as mentioned in its strategy.

Table 14: Synthesis of JREEEF action plan up to 2020 (source: JREEEF)

Target Market	Households	SMEs	Tourism	Hospitals	Public Buildings
Major Focus	Low income households	All SMEs	Small and medium hotels	Small and medium hospitals	Public buildings and facilities not covered by KfW
Basic Strategy	Financial and technical support for PV, SWH and EE lighting projects	Financial/technical support and awareness and communication to install PV, SWH, EE lighting and other EE measures.	Financial/technical support and awareness and communication to install PV, SWH, EE lighting and other EE measures.	Financial/technical support and awareness and communication to install PV, SWH, EE lighting and other EE measures.	Financial/technical support and awareness and communication to install PV, SWH, EE lighting and other EE measures.
Partners and Intermediaries	NGOs, CBOs, Utilities, microfinance organizations, social associations	Commercial banks, microfinance institutions, existing loan guarantee programs	Banks,microfinance institutions, NGOs, utilities,existing loan guarantee programs	Banks,microfinance institutions, NGOs, utilities	Banks, NGOs, utilities
Financial and Technical Support	Grants, revolving credits, guarantees and TA	Grants, revolving credits, and TA	Grants, revolving credits, guarantees and TA	Grants, revolving credits, guarantees and TA	Grants, revolving credits, guarantees and TA
Initial Projects	PV Project - Al Ghour Region; SWH project; and EE lighting project	Interest subsidy program in cooperation with JLGF and one bank	In 2015, market assessment and program design	In 2015, market assessment and program design	In 2015, market assessment and program design for agencies not addressed by KfW
Future Projects	Expansion of PV, SWH and EE lightinbg projects; LED bulb project in refugee areas	Expansion of program with many banks	2016-2018 - one or more programs for small/medium hotels	2016-2018 - one or more programs for small/medium hospitals	2016-2018 - one or more programs for public agencies
Potential Co-Financing	European Union; Canadian DFATD; MoPIC	Commercial banks	Commercial banks	KfW public buildings program; commercial banks	KfW public buildings program; commercial banks
Goals	15,000 PV systems; 50,000 SWH; 150,000 LED tubes and 51,000 LED bulbs	Cumulative SME RE/EE investment of 10 million JD	Cumulative SME RE/EE investment of 5 million JD	Cumulative SME RE/EE investment of 5 million JD	Cumulative SME RE/EE investment of 3 million JD

3.3 MEASURE 29: Energy Efficiency Buildings Codes

Measure	**Energy Efficiency Building Codes enforcement**
Objective	The objective is to reduce energy consumption in new buildings by issuing and enforcing obligatory regulation related to energy performance of the buildings.
Description of the measure	The Ministry of Public Works and Housing has been elaborating, several Building Codes, under the National Jordanian Building Law No.7 - 1993, out of which seven (7) are related to improving the energy performance of buildings: 1. Thermal Insulation Code 2. Updated Mechanical Ventilation and AC Code 3. Updated Central Heating Code 4. Updated Natural Ventilation Code 5. Updated Natural Lighting Code 6. Solar Energy Code 7. Energy Efficient Building Code The last 2 codes which adopted in 2004 since more than 2 years It is planned that all of the energy efficiency building codes will most probably enter in force in 2017. They will allow to reduce, on the long term, the energy consumption in the buildings and improve the comfort of the users.
Implementing agency	Jordan National Building Council (JNBC) under the Ministry of Public Works and Housing, Municipalities.
Stakeholders involved	Jordan National Building Council (JNBC), Municipalities, insulation material suppliers, construction enterprises, Jordan Engineers Association, Jordan Architects Association…
Target group	Residential, commercial and services sectors
Project impacts	If we focus only on the thermal insulation code, the expected annual electricity saving can be estimated to around 650 GWh by 2020. The measure will lead also to a CO_2 emission reduction of about 304 $ktCO_2$ by the year 2020.
Source of funding	Building owners
Financial instruments	The incremental cost linked to the energy efficiency codes implementation will be taken in charge by the buildings' owners. The insulation material and EE equipments that will be used in the buildings to be compliant with the regulation are exempted from taxes.
Awareness	Although the building energy efficiency codes are obligatory, information and awareness on the new codes is highly required. The Jordan National Building Council, with the support of the Jordan Associations of Engineers and Architects, will promote the measure among the construction professionals.
Monitoring and quantification of impact	The monitoring will be insured mainly by the JNBC with the assistance of the Municipalities.

3.4 MEASURE 30: Renewable Energy and Energy Efficiency EU Program (REEE II)

EU is currently providing Technical Assistance to help Jordan developing RE and EE according to its 2007-2020 energy strategy. The technical assistant project (REEEI) –which is part of a wider Energy Sector Policy Support program - with a total budget of 40 M€, funded by EU was implemented during the period 2014-2016.

Its main beneficiaries were:

- Ministry of Energy and Mineral Resources (MEMR)
- Energy and Mineral Regulatory Commission (EMRC)
- National Energy Research Centre (NERC)
- Ministry of Public Works and Housing (MPWH)

This program was completely finished in December 2016. However, a new support to Renewable Energy and Energy Efficiency Program to Jordan (REEE II) is being implemented for the period 2017-2019, with total budget of EUR 90 million.

Measure	**Renewable Energy and Energy Efficiency EU Program (REEE II)**
Objective	The global objective of the program is to contribute to the development and the implementation of effective policies that would help Jordan reaching its renewable energy and energy efficiency targets for 2020. It aims particularly at improving the institutional, legislative and fiscal reform and creating the enabling environment to mobilise public and private actors towards sustainable energy production and consumption patterns.
Description of the measure	The program will be implemented during the period 2017-2019 and will provide technical assistance to the following beneficiaries: - Ministries of Energy and Mineral Resources - Ministry of Public Works and Housing, - Ministry of Water and Irrigation, - Ministry of Environment, - Ministry of Transport - The Greater Amman Municipality, - The National Energy Research Centre (NERC), - The Energy and Mineral Regulatory Commission (EMRC) - National Electric Power Company - Electricity Distribution Companies - Ministry of Municipalities Affairs
Implementing agency	Ministry of Energy and Mineral Resources
Stakeholders involved	All beneficiaries ,related public bodies, international agencies and donors
Target group	EE/RE Sector, Buildings Sector, Water Sector, Transport Sector
Program cost	EUR 90 M (47.5 M Budget Support and 42.5 M Complementary Support).
Impacts of the program	Development and the implementation of effective policies that would help Jordan reaching its renewable energy and energy efficiency targets for 2020.
Source of funding	European Commission
Financial instruments	EU Grant
Awareness	Multi Awareness programs in the EE/RE, Electric Power, Carbon Reduction, Water and Energy Security, Communications and Green Development.
Monitoring and quantification of impact	The monitoring will be ensured by MEMR as implementing agency and the EU Commission according to predefined indicators.

3.5 MEASURE 31: MINARET Project

The MENA Region Initiative as a model of NEXUS Approach and Renewable Energy Technologies (MINARET)

This four-year project, named "The MENA Region Initiative as a model of the NEXUS Approach to Renewable Energy Technologies" (MINARET), is designed to address the unique sustainability challenges and opportunities of the MENA region by applying the "NEXUS" approach, which increases local and regional sustainability capacities using the synergies between renewable energy technology and efficiency, water management and food security.

It is aligned with SIDA's strategy and its goals of environmental improvement, reduced climate impact and increased resilience to environmental impacts, climate change and natural disasters. The project also embraces four of the UN Sustainable Development Goals: SDG 5, Gender equality; SDG 7, Affordable and clean energy; SDG 11, Sustainable cities and communities; and SDG 13, Climate action.

Beneficiaries and target countries include Jordan, Lebanon and Tunisia, focusing on Sahab Municipality and Al Karak Municipality in Jordan, Jdeideh Municipality in Lebanon, and Monastir Municipality in Tunisia.

The aim of the project is to develop capacity at the local and regional levels in addressing climate change issues and impact mitigation. This will be accomplished by building a network of municipal communities that build their local capability for sustainable renewable energy resources, energy efficiency applications, water management techniques and food security approaches. While recognizing the unique nature of each community, the project helps to establish a platform for communicating and sharing policies, practices, experiences and expertise between municipalities and communities throughout the region.

Using a local, bottom-up approach, this project will assist municipal authorities, the private sector and civil society in implementing effective systems and structures to support and help build capabilities, resiliency, and economic, environmental, social and cultural sustainability around renewable energy, water management and food security for those living in their communities (including citizens, immigrants and refugees). This will be done through increased awareness and empowerment of local community organizations, women, youth and other marginalized groups, identifying and supporting opportunities for education, workplace employment and entrepreneurial initiatives.

This project has four Components, with activities designed to identify, analyze and communicate local and regional energy, water and food-related improvement opportunities; assist in the development of capacity and implementation of improvement strategies; and disseminate the results and best practices. Each Component has an overall goal as follows:

1. To identify specific political, technical and human needs and opportunities related to renewable energy, energy efficiency, safe water management and food security for each Municipality.
2. To enhance the political, technical, and human capacities to educate, communicate, and network energy, water, and food sustainability issues both locally and regionally
3. To build local and inter-municipal, regional capacities in energy, water and food sustainability, especially for women, youth and other marginalized groups, through awareness, education, on-the-job training and implementation support for identified sustainability projects, including women's NGOs and entrepreneurial enterprises
4. To report, document and share best sustainability practices and lessons learned, at the local community, country and inter-regional levels, to foster dialogue and ongoing implementation of program results in communities throughout the Region

There are several specific cross cutting issues, including gender mainstreaming throughout the life of the project and beyond; enhancing job creation opportunities and contributing to poverty reduction, especially for women and youth; and improving the quality of life for Syrian refugees in the targeted countries.

As one of the measures of the success of this project, and one of its deliverables, is to provide the opportunity and assist Municipalities to become members of the Covenant of Mayors, demonstrating their commitment to and capability of meeting the environmental governance goals and impact targets of that organization. A number of municipalities in various MENA countries are already progressing towards membership.

3.6 MEASURE 32: CES-MED PROJECT

Overall Objective

The overall objective of the project "Cleaner Energy Saving Mediterranean Cities" is to support local authorities (Municipalities, cities, etc.) in the ENPI South Mediterranean Partner Countries to respond more actively to sustainable policy challenges.

Project Purpose

The main purpose is to develop the capacities of local authorities in the region to formulate and implement more sustainable local policies, such as those implied by joining the Covenant of Mayors and developing the related Sustainable Energy Action Plans (SEAPs). Moreover, the project also aims to make national authorities aware of the need and the advantages of a strong involvement of local authorities in policy issues that have a direct impact on them. Such issues include, among others: local waste and water management, urban mobility and transport, as well as local energy consumption.

Expected Results

1. Improved knowledge of the ENPI South national authorities on the role of local authorities in the field of sustainable policy and progress in the design and implementation of support at national level of this role (for instance: via relevant legislation/regulation, national strategies, state programmes, etc.);

2. Increased capacity of ENPI South Local Authorities with regards to the development and implementation of sustainable policies, including CO2 reductions, expressed by an increase of the use of the participatory methodology and in the application of local policies covering issues such as renewable energy and energy efficiency, efficient water and waste management, the use of environmentally friendly means public transport and mobility and sustainable urban planning;

3. Improved awareness and involvement of the local population regarding sustainable local policies, including sustainable energy;

4. Improved implementation of the Covenant of Mayors in the region. A number of cities in the Mediterranean sign up to the Covenant of Mayors and develop and implement Sustainable Energy Action Plans that are of good quality;

5. Two regional focal points (one in the Maghreb & one in the Mashreq) are established, and able to become Covenant Coordinators/Supporters and/or Covenant of Mayors Offices at a later stage.

CES-MED in Jordan

ASEZA:

Aqaba Municipality joined CES-MED project in the second semester of 2014. Despite all the barriers and obstacles that the municipalities and local authorities face in Jordan, ASEZA intends to convert Aqaba city into a sustainable one through developing short and long term actions and strategies. Also, they intend to make a city of great interest for visitors seeking to discover the unique experience of its local heritage and natural resources.

One of the long term anticipated strategies is developing a Sustainable Energy Action Plan (SEAP) which ASEZA already started with since April 2016 with a full focus on multi potential schemes such as sustainable development, electricity infrastructure, Renewable Energy, reliable public transportation and solid waste.

The ultimate target of the SEAP implementation is to reduce the Carbon footprint of the city by **5% by 2020** (short target), and **15% by 2030** (long target). Moreover, The SEAP acknowledges that making Aqaba city a sustainable community requires the adhesion and collaboration of local, national and international actors. This relies on awareness raising and communication as success factor in the implementation of the SEAP planned projects.

Further, ASEZA is planning to implements the projects below to secure the SEAP short and long targets:

- ✓ Solar Street Lighting
- ✓ Energy Efficient Street Lighting

- ✓ Energy Efficiency Measures in Household Sector
- ✓ Wheeling PV plants
- ✓ Green Buildings Initiatives in the Municipality Buildings
- ✓ Smarter Transportation System
- ✓ Eco-Park

Karak:

Karak Municipality joined CES-MED project in the next semester of 2014 as well. Karak also intends to convert Karak city into a sustainable one through developing short and long term actions and strategies.

Same as Aqaba, karak is progressing very well in developing their SEAP where they started the process in June 2016. They also focus on multi potential schemes such as Solid Waste, electricity infrastructure, Renewable Energy, and Human Development (capacity building).

The ultimate target of Karak's SEAP is to reduce the Carbon footprint of the city by **5% by 2020** (short target), and **14% by 2030** (long target) through developing multi-potential projects:

- ✓ Solar Street Lighting
- ✓ Energy Efficient Street Lighting
- ✓ Energy Efficiency Measures in Household Sector
- ✓ Wheeling PV plants (8 MWp is under progress)
- ✓ Electricity Generation from Waste Energy

Irbid:

Irbid also started developing their SEAP during the second semester of 2016 where its target is to reduce the Carbon footprint of the city by **5% by 2020** (short target), and **15% by 2030** (long target) through developing multi-potential projects:

- ✓ Solar Street Lighting
- ✓ Energy Efficient Street Lighting
- ✓ Energy Efficiency Measures in Household Sector
- ✓ Wheeling PV plants (16 MWp is under progress) to fully cover the city's demand
- ✓ Electricity Generation from Waste Energy (Bio-gas)
- ✓ Green Buildings Initiatives in the Municipality Buildings

Project Duration: 2014-2017

Project Beneficiaries in Jordan: Aqaba, Karak and Irbid Municipalities

Project Donor: EU Commission

3.7 MEASURE 33: SUDEP / Sahab Project

The Main objective is to enable Sahab Municipality in Jordan to be a pilot for the local authorities in ENPI South partner countries to address local sustainable development challenges related to energy.

This will be achieved through the following:

- Develop a local Energy Efficiency & Renewable Energy Plan for Sahab Municipality.
- Promote and implement energy efficiency, energy savings & renewable energy measures at Sahab Municipality buildings and Introduce energy efficient technologies
- Build capacities of employees of Sahab Municipality in the field of sustainable energy & public awareness of the general public and relevant stakeholders.
- Enable Sahab to become a model Municipality through joining the Convention of Mayors and through implementing energy efficiency demonstration pilots.

Multi EE/RE measures were implemented in 12 different municipal buildings, schools, Mosques and Public Areas & Streets.

Sahab also developed its own SEAP with short-term target of energy / carbon reduction is **5%** of overall Sahab consumptions by **2020**, while the long-term target of energy / carbon reduction is **14% by 2030**.

Measures were as follows:

- ✓ Energy Efficient Street Lighting
- ✓ Energy Efficiency Measures in different buildings
- ✓ PV Systems for different buildings
- ✓ Green Buildings Initiatives in the Municipality Buildings
- ✓ Grey-water harvesting
- ✓ Awareness Campaigns

Project Duration: 2015-2017

Project Beneficiaries in Jordan: Sahab Municipality

Project Donor: EU Commission

3.8 MEASURE 34: National Green Growth Plan (GGGI Jordan)

The Government of Jordan has committed to developing a National Green Growth Plan (NGGP) that is in line with national objectives of economic, social and environmental performance. GGGI is partnering with the Ministry of Environment (MoENV) to support the development of the NGGP by:

- ✓ Identifying green growth opportunities and Green Key Performance Indicators to be included in the NGGP
- ✓ Designing a cross-sector green growth policy framework and implementation roadmap
- ✓ Facilitating institutional and stakeholder engagement to provide a platform that will attract long-term financing
- ✓ Facilitating knowledge-sharing activities in support of sector strategies
- ✓ The overall objectives of this project are to develop a national green growth strategy, with supporting action plans that enhance existing data deficiencies, action-plan recommendations, stakeholder engagement, and sharing of expertise.

Source : www.greengrowthknowledge.org/project/gggi-jordan-national-green-growth-plan

4 Criteria to assess energy efficiency policy implementation progress

The following table presents the main indicators to monitor the progress of the implementation of the measures proposed in the Jordan NEEAP 2016-2020.

Table 15: Main progress indicators for NEEAP monitoring and Evaluation

No	Measures	Progress indicators
	Sectorial measures	
	Residential sector	
1	Replacement incandescent lamps with LED for low and medium income households classes	- Number of beneficiaries (households) per year - Number of distributed and installed LEDs per year
2	Enforcement of Energy Label and standards program for 4 home appliances	- Effectiveness of regulation enforcement - Penetration rate of efficient appliances in the market
3	EE building codes enforcement in residential sector	- Number of new dwellings per year compliant with the thermal insulation code - Number of m² of space of new dwellings compliant with the thermal insulation code
4	Program for roof insulation of existing building in residential sector	- Number of dwellings per year insulated within the program - Number of m² of roof insulated each hear within the program - Energy consumption per in kWh/m² for insulated dwellings
	Commercial and Services sector	
6	Replacement of Fluorescent Tubes in public buildings	- Number of replaced Fluorescent Tubes in public buildings within the program each year
7	Energy efficiency in health centers	- Number of health centers achieved each year - Number of m² of the achieved health centers each year - Type of EE measures implemented - Yearly energy saving estimation after the implementation of the EE measures in the targeted health centers
8	Replacement of Fluorescent Tubes in commercial buildings by LEDs	- Number of installed LEDs per year within the program
9	Energy efficiency in existing small and medium hotels	- Number of hotels achieved each year - Number of m² of the achieved hotels each year - Type of EE measures implemented - Yearly energy saving estimation after the implementation of the EE measures in the targeted hotels
10	EE building codes enforcement in tertiary sector	- Number of buildings per year compliant with the thermal insulation code - Number of m² of space of new buildings compliant with the thermal insulation code
	Industry sector	
11	EE program in industrial Sector by 50 energy audits & implementation per year	- Number of energy audits achieved per year - Number of energy audits implemented per year - Yearly energy saving estimation of implemented audits

	Water pumping sector	
12	EE for Wala-Lib pumping	
13	WWTP Wadi Shalala	- Progress of the works according to the planning of the program
14	EE Program I	
15	WWTP Irbid + Wadi Arab Digesters	
16	EE Program II	- Yearly energy saving estimation of the implemented projects
17	Introduction regular energy Audits	
18	Aqeb Conveyor Project	
19	EE for Baqorieh pumping station	
20	EE at Zarqa pumping stations	
21	Replacement 25 pumps Zara Ma'en	
22	EE at Zai pumping station	
	Street lighting	
23	Replacement of Mercury lamps by efficient lamps & use Automatic street lighting controls &voltage regulators	- Number of targeted Municipalities - Number of replaced Mercury lamps of street lighting - Yearly energy saving from the program
	Energy Efficiency Municipalities	
24	EE in Al Karak Building Municipality	Verifiable indicators as set up for the buildings and street lighting of the municipality.
25	EE Street lighting Al Karak Municipality	
	Transport Sector	
26	Transport sector	The objectively verifiable indicators, as will be set up in the Transport Plan expected by 2018
	Cross-cutting measures	
27	RE and EE Custom Duties and Sale Taxes exemption	- Number of EE equipment and materiel in the list of exemption - Number of applications of exemption per year - Total amount of exemption of taxes and Customs duties provides by the government (MJD per year)
28	Jordan Renewable Energy and Energy Efficiency Fund (JREEEF)	- Total resources collected by JREEEF each year - Total amount of fund disbursed by JREEEF by type of mechanism (subsidy, loan, guarantee, etc.)
29	Energy Efficiency Buildings Codes	- Finalization of the enforcement procedures - Effective date of enforcement of the codes - Effectiveness of the regulation implementation
30	EU funded- RE & EE Program in Jordan (REEE II TA)	- The objectively verifiable indicators, as set up in program document
31	Minaret project	The objectively verifiable indicators, as set up in program document
32	CES-Med project	The objectively verifiable indicators, as set up in program document
33	SUDEP project	The objectively verifiable indicators, as set up in program document
34	National Green Growth Plan for Jordan	National Green Growth Plan (NGGP) by MoENV

Main references

- New Jordan Strategy 2015-2025, MEMR, 2016
- Energy demand forecast using TIMES model, George Giannakidis, EU/MEMR, 2016
- First Jordan NEEAP 2012-2014, MEMR
- JREEEF Strategy, JREEEF, 2015.
- Energy survey in residential sector, MEMR, 2013
- Energy survey in transport sector, MEMR, 2012
- Energy survey in commercial and services sector, MEMR, 2014
- Energy Strategy of Jordan 2007-2020, MEMR, 2007
- REEE II TA Program - Inception Report –January 2017
- Annual Reports of MEMR, MEMR, 2010-2015
- Annual Reports of EMRC, EMRC, 2010-2014
- Annual Reports of NEPCO, NEPCO, 2010-2015
- Energy Efficiency Building Codes, JNBC, 2016
- Energy Laws and By-Laws in Jordan, MEMR
- Demography census of 2015, DOS, 2015
- The Demographic Profile of Jordan and population trends, DOS, 2014
- Third National Communication of Jordan, Ministry of Environment 2014
- Project document of the program of EE in public building, Econoler, 2012
- Electrical Demand forecast, NEPCO, 2015
- Energy Efficiency and Renewable Energy in the Water Sector Policy, 2016 (2025 targets)
- National Green Growth Plan for Jordan (GGGP Jordan) Quantitative & statistical assessment carried out to implement the Arab EE Framework: Follow-up qualitative development & quantitative impact survey for 2014, RCREEE, 24 Dec. 2014.
- Arab Future Energy Index (AFEX Energy Efficiency 2015), RCREEE, 2015.

Annexes

Annex 1: Example of assumptions of EES in residential and tertiary sectors

Residential

ProcessDesc\Period	Share			
	2014	2020	2025	2030
Air heat pump.HeatCool	0,0%	10,0%	20,0%	30,0%
Electric radiators	0,0%	5,4%	7,4%	7,8%
Ground heat pump.HeatCool	0,0%	0,0%	0,0%	0,0%
LPG boiler	0,0%	4,2%	6,3%	6,4%
LPG boiler.HeatHotwater	0,0%	0,0%	0,0%	0,0%
LPG stove	0,0%	0,8%	0,9%	0,0%
Oil boiler	0,0%	31,9%	31,0%	35,7%
Oil boiler condensing.HeatHotwater	0,0%	6,6%	15,0%	20,0%
Oil boiler.HeatHotwater	0,0%	0,0%	0,0%	0,0%
Rsd.Space Heat.Single.Rural.ELC.00.Heat Pump.	5,1%	2,8%	1,2%	0,0%
Rsd.Space Heat.Single.Rural.ELC.00.Resistance.	17,5%	2,3%	4,1%	0,0%
Rsd.Space Heat.Single.Rural.KER.00	25,8%	13,9%	6,0%	0,0%
Rsd.Space Heat.Single.Rural.LPG.00	10,3%	3,7%	0,0%	0,0%
Rsd.Space Heat.Single.Rural.OIL.00.Dual boiler.	41,3%	18,4%	8,1%	0,0%
	100%	100,0%	100,0%	100,0%

ProcessDesc\Period	Share			
	2014	2020	2025	2030
Electric boiler water heater resistance	0,0%	0,8%	7,6%	11,3%
Electric heat pump water heater	0,0%	0,0%	22,7%	20,9%
LPG boiler water heater	0,0%	14,5%	0,0%	0,0%
LPG boiler.HeatHotwater	0,0%	0,0%	0,0%	0,0%
Rsd.Water Heat.Single.Rural.ELC.00.Water heater.	31,6%	16,2%	6,6%	0,0%
Rsd.Water Heat.Single.Rural.LPG.00.	14,7%	2,4%	1,0%	0,0%
Rsd.Water Heat.Single.Rural.SOL.00.	53,7%	27,5%	11,1%	0,0%
Solar collector with electric backup.HeatHotwater	0,0%	38,5%	51,0%	67,8%
	100,0%	100,0%	100,0%	100,0%

ProcessDesc\Period	Share			
	2014	2020	2025	2030
Air heat pump.HeatCool	0,0%	5,0%	17,5%	30,0%
Centralized electrical air conditioner	0,0%	55,3%	79,6%	70,0%
Ground heat pump.HeatCool	0,0%	0,0%	0,0%	0,0%
Room air-conditioner	0,0%	0,7%	0,0%	0,0%
Rsd.Space Cool.Single.Rural.ELC.00.Central.	7,5%	4,1%	1,7%	0,0%
Rsd.Space Cool.Single.Rural.ELC.00.Splits.	87,4%	32,1%	0,0%	0,0%
Rsd.Space Heat.Single.Rural.ELC.00.Heat Pump.	5,1%	2,8%	1,2%	0,0%
	100,0%	100,0%	100,0%	100,0%

ProcessDesc\Period	Share			
	2014	2020	2025	2030
Fluorescent lighting system	0,0%	0,0%	29,3%	19,5%
Halogens lighting system	0,0%	39,1%	0,0%	0,0%
Incadescent lighting system	0,0%	1,1%	0,9%	0,6%
LED lighting system	0,0%	57,8%	69,8%	79,9%
Rsd.Lighting.ELC.00.Fluorescent.	82,9%	0,0%	0,0%	0,0%
Rsd.Lighting.ELC.00.Incandescent.STD.	5,7%	0,0%	0,0%	0,0%
Rsd.Lighting.ELC.00.LED.	11,4%	2,0%	0,0%	0,0%
	100,0%	100,0%	100,0%	100,0%

Commercial

ProcessDesc\Period	2014	2020	2025	2030
Adv Air heat pump .HeatCool	0,0%	20,0%	21,9%	21,5%
Air heat pump HeatCool	0,0%	0,0%	0,6%	3,5%
Com.Space Heat.ELC.00.Heat Pump.	12,0%	7,5%	4,8%	2,1%
Com.Space Heat.ELC.00.Resistance.	1,7%	0,0%	0,7%	0,0%
Com.Space Heat.OIL.00.	34,5%	21,7%	13,7%	6,0%
Com.Space Heat.OIL.00.Dual Boiler.	51,8%	20,7%	13,1%	5,7%
Electric boiler	0,0%	0,0%	0,0%	0,0%
Ground heat pump.HeatCool	0,0%	0,0%	10,5%	20,0%
Insulation Com	0,0%	0,0%	0,0%	0,0%
Oil boiler	0,0%	6,9%	11,4%	15,5%
Oil boiler condensing.HeatHotwater	0,0%	23,2%	23,4%	25,8%
Oil boiler.HeatHotwater	0,0%	0,0%	0,0%	0,0%
	100,0%	100,0%	100,0%	100,0%

ProcessDesc\Period	2014	2020	2025	2030
Adv Air heat pump .HeatCool	0,0%	20,0%	22,5%	0,0%
Air heat pump HeatCool	0,0%	0,0%	0,0%	25,0%
Com.Space Heat.ELC.00.Heat Pump.	49,1%	30,4%	18,7%	7,9%
Com.Space Heat.ELC.00.Resistance.	7,0%	0,0%	2,7%	0,0%
Com.Space Heat.LPG.00.	3,9%	2,4%	1,5%	0,6%
Com.Space Heat.OIL.00.	40,0%	22,1%	13,5%	5,7%
Electric boiler	0,0%	0,0%	30,6%	0,0%
Ground heat pump.HeatCool	0,0%	0,1%	10,5%	20,0%
Insulation Com	0,0%	0,0%	0,0%	0,0%
LPG boiler	0,0%	25,0%	0,0%	40,7%
Oil boiler	0,0%	0,0%	0,0%	0,1%
	100,0%	100,0%	100,0%	100,0%

ProcessDesc\Period	2014	2020	2025	2030
Com.Space Cool.ELC.00.Central.	3,5%	1,8%	0,7%	0,0%
Com.Space Cool.ELC.00.Fans.	0,1%	0,0%	0,0%	0,0%
Com.Space Heat.ELC.00.Heat Pump.	96,4%	57,8%	33,9%	13,8%
Insulation Com	0,0%	0,0%	0,0%	0,0%
Nonreversible electricity heat pump	0,0%	40,4%	59,5%	80,9%
Rooftop central electric chiller	0,0%	0,0%	5,8%	5,3%
	100,0%	100,0%	100,0%	100,0%

ProcessDesc\Period	2014	2020	2025	2030
Air heat pump HeatCool	0,0%	3,4%	22,5%	25,0%
Com.Space Cool.ELC.00.Central.	35,6%	17,9%	7,4%	0,0%
Com.Space Cool.ELC.00.Fans.	1,4%	0,0%	0,0%	0,0%
Com.Space Heat.ELC.00.Heat Pump.	62,9%	37,0%	22,2%	9,1%
Insulation Com	0,0%	0,0%	0,0%	0,0%
Nonreversible electricity heat pump	0,0%	41,7%	47,9%	65,9%
Rooftop central electric chiller	0,0%	0,0%	0,0%	0,0%

ProcessDesc\Period	2014	2020	2025	2030
Adv Air heat pump .HeatCool	0,0%	7,0%	22,5%	22,3%
Air heat pump HeatCool	0,0%	0,0%	0,0%	2,7%
Com.Space Cool.ELC.00.Central.	16,3%	8,0%	3,1%	0,0%
Com.Space Cool.ELC.00.Fans.	0,7%	0,0%	0,0%	0,0%
Com.Space Heat.ELC.00.Heat Pump.	83,0%	47,6%	26,7%	10,4%
Ground heat pump.HeatCool	0,0%	0,0%	12,5%	20,0%
Insulation Com	0,0%	0,0%	0,0%	0,0%
Nonreversible electricity heat pump	0,0%	37,4%	35,2%	44,6%
Rooftop central electric chiller	0,0%	0,0%	0,0%	0,0%

ProcessDesc\Period	2014	2020	2025	2030
Adv Air heat pump .HeatCool	0,0%	6,3%	22,5%	25,0%
Com.Space Cool.ELC.00.Central.	76,3%	38,5%	16,1%	0,0%
Com.Space Cool.ELC.00.Fans.	3,1%	0,0%	0,0%	0,0%
Com.Space Heat.ELC.00.Heat Pump.	20,7%	12,2%	7,4%	3,0%
Ground heat pump.HeatCool	0,0%	0,0%	12,5%	20,0%
Insulation Com	0,0%	0,0%	0,0%	0,0%
Nonreversible electricity heat pump	0,0%	43,0%	41,6%	52,0%
Rooftop central electric chiller	0,0%	0,0%	0,0%	0,0%

ProcessDesc\Period	2014	2020	2025	2030
Adv Air heat pump .HeatCool	0,0%	3,2%	19,7%	24,9%
Air heat pump HeatCool	0,0%	3,1%	2,8%	0,1%
Com.Space Cool.ELC.00.Central.	17,4%	8,7%	3,5%	0,0%
Com.Space Cool.ELC.00.Fans.	0,7%	0,0%	0,0%	0,0%
Com.Space Heat.ELC.00.Heat Pump.	81,9%	47,9%	28,0%	11,3%
Ground heat pump.HeatCool	0,0%	0,0%	12,5%	14,5%
Insulation Com	0,0%	0,0%	0,0%	0,0%
Nonreversible electricity heat pump	0,0%	37,0%	33,6%	49,2%
Rooftop central electric chiller	0,0%	0,0%	0,0%	0,0%

ProcessDesc\Period	2014	2020	2025	2030
Com.Lighting.ELC.00.Fluorescent.	66,7%	0,0%	0,0%	0,0%
Com.Lighting.ELC.00.Incandescent.STD.	1,6%	0,0%	0,0%	0,0%
Com.Lighting.ELC.00.LED.	31,7%	5,9%	0,0%	0,0%
Fluorescent lighting system	0,0%	3,2%	2,1%	1,0%
Incandescent STAD lighting system	0,0%	1,6%	1,5%	1,3%
LED lighting system	0,0%	89,3%	96,4%	97,6%

ProcessDesc\Period	2014	2020	2025	2030
Com.Lighting.ELC.00.Fluorescent.	66,7%	0,0%	0,0%	0,0%
Com.Lighting.ELC.00.Incandescent.STD.	1,6%	0,0%	0,0%	0,0%
Com.Lighting.ELC.00.LED.	31,7%	5,9%	0,0%	0,0%
Fluorescent lighting system	0,0%	3,2%	2,1%	1,0%
Incandescent STAD lighting system	0,0%	1,6%	1,5%	1,3%
LED lighting system	0,0%	89,3%	96,4%	97,6%

ProcessDesc\Period	2014	2020	2025	2030
Com.Lighting.ELC.00.Fluorescent.	66,7%	0,0%	0,0%	0,0%
Com.Lighting.ELC.00.Incandescent.STD.	1,6%	0,0%	0,0%	0,0%
Com.Lighting.ELC.00.LED.	31,7%	5,9%	0,0%	0,0%
Fluorescent lighting system	0,0%	4,6%	3,4%	2,2%
Incandescent STAD lighting system	0,0%	0,2%	0,2%	0,2%
LED lighting system	0,0%	89,3%	96,4%	97,6%

ProcessDesc\Period	2014	2020	2025	2030
Com.Lighting.ELC.00.Fluorescent.	66,7%	0,0%	0,0%	0,0%
Com.Lighting.ELC.00.Incandescent.STD.	1,6%	0,0%	0,0%	0,0%
Com.Lighting.ELC.00.LED.	31,7%	5,9%	0,0%	0,0%
Fluorescent lighting system	0,0%	3,2%	2,1%	1,0%
Incandescent STAD lighting system	0,0%	1,6%	1,5%	1,3%
LED lighting system	0,0%	89,3%	96,4%	97,6%

ProcessDesc\Period	2014	2020	2025	2030
Com.Lighting.ELC.00.Fluorescent.	66,7%	0,0%	0,0%	0,0%
Com.Lighting.ELC.00.Incandescent.STD.	1,6%	0,0%	0,0%	0,0%
Com.Lighting.ELC.00.LED.	31,7%	5,9%	0,0%	0,0%
Fluorescent lighting system	0,0%	3,2%	2,1%	1,0%
Incandescent STAD lighting system	0,0%	1,6%	1,5%	1,3%
LED lighting system	0,0%	89,3%	96,4%	97,6%

Annex 2: Calculation of the measures impacts of the NEEAP

Residential sector

Replacement incandescent lamps with LED in residential sector

	Incanescent	LED
Lamp power	0,1	0,015
hrs/day	5	5
hrs/year	1825	1825

No. of lamps Incand	1 000 000
No. of lamps LED	1 000 000
life time of LED	30 000 hrs
life time of inc	1 000 hrs
No. of inc lamps needed	30 lamps
lamp cost-LED	10,00 JD
lamp cost-inc	0,30 JD
Total cost-LED	10 000 000 JD
Total cost-LED	14 285 714 USD
Total cost-inc-during life time of LED	9 000 000 JD
Total cost-inc-during life time of LED	12 857 143 USD
consumption for INC during lifetime of L	3 000,00 GWh
consumption for LED during lifetime of l	450,00 GWh
saving during life time of LED	2 550,00 GWh
Annual consumption for INC	182,500 GWh
Annual consumption for LED	27,375 GWh
Annual saving	155,125 GWh
Average cost per KWh	0,077 JD/KWh
Average cost per KWh	0,110 USD/KWh
cost saving	11 934 283 JD
cost saving	17 048 976 USD
Cost per kwh saved	0,00392 JD/KWh
Cost per kwh saved	0,006 USD/KWh
Demand Reduction	68 MW
CO2 Reduction	73 ktCO2

Enforcement of Energy Label and standards program for 4 home appliances

			Savings
Residential sector consumption (average referance year)			4 447 GWh
Energy Label saving per year,(Home appliances Market study, NERC & UNDP, 2012)			275 GWh
savings by 2020			400 GWh
cost savings			21 MJD
Co2 reduction per year (Home appliances Market study,			30 M USD
Cost of kwh saved per year (JD/KWh) (Home appliances			187 ktCO2
Cost of kwh saved per year (USD/KWh) (Home appliances Market study, NERC & UNDP), average			-0,0169

Appliance	Savings (MWh/year	cost of MWh saved USD/MWh	cost of KWh saved USD/KWh	cost of KWh saved JD/KWh	Savings Tonnes CO2/year	cost of Tonnes CO2 saved USD/Tonnes CO2
Air conditione	51443	-33,9	-0,0339	-0,02404	34467	-50,62
Refrigerators	67391	-26,2	-0,0262	-0,01858	45152	-39,03
Freezers	72541	-21,7	-0,0217	-0,01539	48602	-32,37
Washing Mac	83645	-13,7	-0,0137	-0,00971	56042	-20,47
Total/avearge	275020	-23,875	-0,023875	-0,01693	184263	-35,6225

Program for roof insulation of existing building in residential sector

Target houses by 2020	15000	Houses (H)
Number of m²	140	m²/H
Total m²	2 100 000	m²/H
heat consumption	41	kWh/m²
air conditioning consumption	24	kWh/m²
Total heat consumption	86 730 000	kWh/year
Total air conditioning consumption	50 113 636	kWh/year
Total consumption	136 843 636	kWh/year
Saving ratio	30%	
Total saving/year	41 053 091	kWh/year
Total saving/year	41	GWh/year
Liftime	20	years
Total saving on lifetime	821 061 818	
Cost per m²	22	$/m²
Program cost	32 340 000	JD
Program cost	46 200 000	$
Cost of saved kWh	0,056	$/kWh
Cost of saved kWh	0,039	JD/kWh
Saving bill for HH	7 414 680	JD
Electricity emission factor	468	tCO2/kWh
Emission reduction	19 213	tCO2

EE building codes enforcement in residential sector (just insulation)

Target houses by 2020	66000	Houses (H)
Number of m²	140	m²/H
Total m²	9 240 000	m²/H
heat saving	32	kWh/m²
air conditioning saving	11	kWh/m²
Total air conditioning consumption	295 680 000	kWh/year
Total consumption	101 640 000	kWh/year
Total saving/year	397 320 000	kWh/year
Total saving/year	397	GWh / year
Liftime	20	years
Total saving on lifetime	7 946 400 000	
Cost per m²	40	$/m²
Program cost	258 720 000	JD
Program cost	369 600 000	$
Cost of saved kWh	0,047	$/kWh
Cost of saved kWh	0,033	JD/kWh
Saving bill for HH	74 474 400	JD
Emission factor of electricity	468	tCO2/kWh
Emission reduction	185 946	tCO2

Commercial and services sectors

Replacement of Fluorescent Tubes in public buildings

	Incanescent	LED
Lamp power	0,1	0,04
hrs/day	8	8
hrs/year	1960	1960

No. of lamps (4 Tubes in each each)	80000
No. of lamps (4 LED in each each)	80000
life time of LED tube	30 000 hrs
life time of Fluorescent	1 000 hrs
No. of Fluorescent lamps needed during LED life	3 lamps
lamp cost-LED	15,00 JD
lamp cost-Fluorescent	1,50 JD
Total cost-LED	1 200 000 JD
Total cost-LED	1 714 286 USD
Total cost-Fluorescent-during life time of LED	360 000 JD
Total cost-Fluorescent-during life time of LED	514 286 USD
consumption for Fluorescent during lifetime of LE	240,00 GWh
consumption for CFL during lifetime of LED	96,00 GWh
saving during life time of LED	144,00 GWh
Annual consumption for INC	3,92 GWh
Annual consumption for LED	1,57 GWh
Annual saving	2,35 GWh
Average cost per KWh	0,223 JD/KWh
Average cost per KWh	0,318 USD/KWh
cost saving	523 516 JD
cost saving	747 880 USD
Cost per kwh saved	0,00833 JD/KWh
Cost per kwh saved	0,012 USD/KWh
CO2 Reduction	2 ktCO2
Power Demand Reduction	4 MW

Replacement of Fluorescent Tubes in private buildings

Fluorescent Unit watts	**100,00 w**	
LED Unit watts	**40,00 w**	
Savings	**0,06 KW**	
Estimated no. of 4x18 watt Units	**250 000 units**	
Cost of LED Lamp	15	
Number of LED lamps	$ 1 000 000	
program cost	15 000 000 JD	
	21 428 571 USD	
cost of KWh saved	0,033 JD/KWh	based on 30000 hours life time of the LED
	0,048 USD/KWh	
max tariff	0,181 JD/KWh	if consump. Is more than 2000 kwh/moth
mini tariff	0,129 JD/KWh	if consump. Is below 2000 kwh/moth

annual saving	Cost saving	Demand Reduction	CO2 Reduction
66 GWh	**10 183 500 JD**	25,3 MW	44 ktCO2
	14 547 857 USD		

EE building codes enforcement in tertiary sector (Just insulation)

	m²/unit	N Buildings in 2020	m²	AC kWh/m²	Heat kWh/m²	Total kWh	Cost /m² $	Total cost $
Tourism Sector	2340	714	1 670 713	10	20	50 121 388	30	50 121 388
Health (Hospitals and Clinics)	634	388	246 025	24	35	14 515 496	35	8 610 888
Commerce	58	3774	218 869			-		-
Education	3969	516	2 049 416	10	68	159 854 458	30	61 482 484
Offices	1839	275	506 082	17	31	24 291 959	30	15 182 474
		5667	**4 691 105**			**248 783 301**		**135 397 233**

Program Cost	135 397 233	JD
Program Cost	94 778 063	$
Coût kWh saved	0,036	$
Coût kWh saved	0,025	JD
Total program saving	26 513 989	$
Total program saving	18 559 793	JD
Total saving	249	GWh
Emission reduction	116 431	tCO2

Jordan public building energy efficiency program (KfW)

Emission reduction	17000	TCO2
Emission factor of electricity	468	tCO2/GWh
Electricity saving	36	GWh
Cost of the program	15 000 000	€
Cost of the program	12 000 000	JD
Cost of the program	17 142 857	$
Cost of saved kWh	0,028	€/kWh
Cost of saved kWh	0,022	JD/kWh
Cost of saved kWh	0,031	$/kWh
Bill saving	7	MJD

Energy efficiency in existing small and medium hotels

Total Cost	5	MJD
Total Cost	7	M$
AC consumption	40	kWh/m²
Heat consumption	22	kWh/m²
Total consumption	**62**	kWh/m²
Saving ratio	60%	
AC consumption saving	24	kWh/m²
Heat consumption saving	13	kWh/m²
Total saving	**37**	kWh/m²
Cost of program per m²	25	$/m²
Avrage surface per unit	2324	m²
Total space m²	285 714	m²
Number of Units	123	units
Saving of electricity	10 550 649	kWh/m²
Saving of electricity	11	GWh
CO2 reduction	4 938	ktCO2
Saved kWh cost	0,032	JD/kWh
Saved kWh cost	0,045	$/kWh
Total bill saving	1 987 810	JD

Energy efficiency in existing health centers

Total Cost	5	MJD
Total Cost	7	M$
AC consumption	50	kWh/m²
Heat consumption	20	kWh/m²
Total consumption	**70**	kWh/m²
Saving ratio	60%	
AC consumption saving	30	kWh/m²
Heat consumption saving	12	kWh/m²
Total saving	**42**	kWh/m²
Cost of program per m²	25	$/m²
Avrage surface per unit	634	m²
Total space m²	285 714	m²
Number of Units	451	units
Saving of electricity	12 000 000	kWh
Saving of electricity	12	GWh
CO2 reduction	5 616	ktCO2
Saved kWh cost	0,028	JD/kWh
Saved kWh cost	0,040	$/kWh
Total bill saving	2 306 667	JD

Industrial sector

EE program in industrial Sector

Company	Saving (JD)	Pay Back Period	% of saving	saving
Arab Electrical Industries (AEI)	32 308	1,61	30,40%	0,60 GWh
National Chlorine Industries (NCI)	113 426	0,81	3,97%	2,10 GWh
Jordanian Cypriot Construction Industries Company (JCCIC)	12 676	0,88	13,20%	0,23 GWh
Arab Medical Container	46 362	1,52	22,00%	0,86 GWh
Saudi Jordanian Industrial Development Co	177 590	0,46	29,80%	3,29 GWh
Alpha Beta for Food Industries	76 600	0,5	60,80%	1,42 GWh
Quality food product company	22 139	0,74	44,50%	0,41 GWh
Jordan paper and cardboard factories	137 869	0,79	24,20%	2,55 GWh
Jordan Ceramic Industries Co.	123 823	1,67	9,00%	2,29 GWh
Jordan Vegetable Oil Industries Co.	57 821	1,76	19,70%	1,07 GWh
Ahli plastic factory	157 230	1,36	63,80%	2,91 GWh
Al- Nayrooz Plastic Factory – Phase Two	2 013	1,12	10,70%	0,04 GWh
Le Meridian Hotel	203 989	1,87	26,30%	3,78 GWh
United Iron and Steel Manufacturing Company	1 812 282	3,55	64,10%	33,56 GWh
Jordan Phosphate Mines	380 691	4,04	11,50%	7,05 GWh
Canning Company	29 725	2,06	36,00%	0,55 GWh
RUM Manufacturing Company	29 027	0,93	29,70%	0,54 GWh
Al-Nasser Group	17 269	1,77	35,00%	0,32 GWh
Halawani Industry Company	52 071	1,3	19,50%	0,96 GWh
American Jordanian Company for Apparel	72 183	0,46	15,00%	1,34 GWh
Technical Packaging Co.	29 753		36,00%	0,55 GWh
KEMAPCO	631 175	0,55	15,00%	11,69 GWh
				3,55 GWh
				2,13 GWh
		Saving per year		32 GWh
		Saving by 2020		383 GWh

Bill saving	53	MJD
Bill saving	75	MUSD
Program cost	105	MJD
Program cost	150	MUSD
Cost of saved kWh	0,055	JD/KWh
Cost of saved kWh	0,078	$/KWh
Emission reduction of CO2	179	ktCO2

Water pumping sector

Phase 1-Improvement of Energy Efficiency of the Water Authority of Jordan (IEE) & Phase 2- (EEP).

Pumping Station	Saving	Project Cost (JD)	Cost of KWh Saved	Bill Saving
EE for Baqorieh pumping station (pilot project). Funded by KFW. Bill Reduction : 150000 JD at a rate of 0.1 JD/KWh. CO2 reduction:1100 ton/year	1 500 000,00 KWh	600 000	0,080 JD/KWh	150 000
EE for Wala & Lib/Madaba pumping station. Funded by giz & private sector (24% from donors, 76% private sector, project cost:726,426 euro, Bill Reduction : 360,000 JD at a rate of 0.1 JD/KWh. Co2 reduction: 2500 ton/year	3 600 000 KWh	581 141	0,032 JD/KWh	360 000
EE for pumping stations. Funded by KFW 81%, public funding 19%, project cost: 32 million euro, Bill Reduction : 6920495 JD at a rate of 0.1 JD/KWh.	69 204 592 KWh	25 600 000	0,074 JD/KWh	6 920 495
EE at Zarqa Governorate pumping stations. Funded by JICA 87.5%, public funding 12.5% project cost: 12 million JD, Bill Reduction : NA. objective : to enhance the efficiency of pumping netw orks in Zarqa station, Azraq station, Halabat Station and Khaw Station.	193 268 740 KWh	12 000 000	0,062 JD/KWh	19 326 874
Total/average	268 GWh	38,78 M JD	0,062 JD/KWh	26 757 369

annual saving	bill saving	ad Demand Reducti	CO2 Reduction
268 GWh	**26 757 369 JD**	53,6 MW	125 ktCO2

Street lighting sector

Street lighting program

	%	Numbers
Total installed lamps	**100%**	**330000**
400 W HPS	10%	33000
250 W HPS	20%	66000
125 W Mercury	40%	132000
70 W HPS	30%	99000

Working number of hours per day of lamps	12	hours
Wattage of Mercury lamp to replaced	125	W
Wattage of LED	30	W
Annual saving of electricity	55	GWh
Power reduction	12,54	MW
Emission factor of electricity sector	468	tCO2/GWh
Emission reduction	26	ktCO2
Cost of replacement per lamp	80	JD
Cost of the program	10,56	MJD
Cost of the program	15	M$
Cost of saved kWh	0,06	JD/kWh
Cost of saved kWh	0,09	$/kWh
Tariff of street lighting	0,114	JD/kWh
Total saving to Municipalities	3	MJD
Total saving to Municipalities	4	M$