



THE HASHEMITE KINGDOM OF JORDAN

The Ministry of Energy and Mineral Resources

Annual Report **2016**





His Majesty King Abdullah II Bin Al Hussein





H.R.H Crown Prince Hussein Bin Abdullah II





Contents

Vision	9
Mission	9
Core Values	9
Strategic Objectives	9
Organizational Structure	10
Terms and Abbreviations	11
Significant Statistics of Energy and Economy in Jordan 2016	13
Introduction	14
Development of Oil and Natural Gas Sectors	17
On Arab and International Levels	17
On Local Level	18
The Institutions of the Energy Sector in 2016	19
Energy Sources in Jordan	23
Domestic Demand for Energy and Electricity	24
Crude Oil and Oil Products	24
Natural Gas	25
Primary and Final Energy Consumption	25
Oil Products Consumption and Prices	27
Electricity	31
Electricity Generation and Consumption	31
Electricity Tariff	34
Rural Electrification	36
Most Significant Accomplishments of the Energy and Mineral Resources Sectors in 2016	38
The Financial Statements	67





Vision

Achieving a secure sustainable supply of energy and optimal utilization of natural resources.

Mission

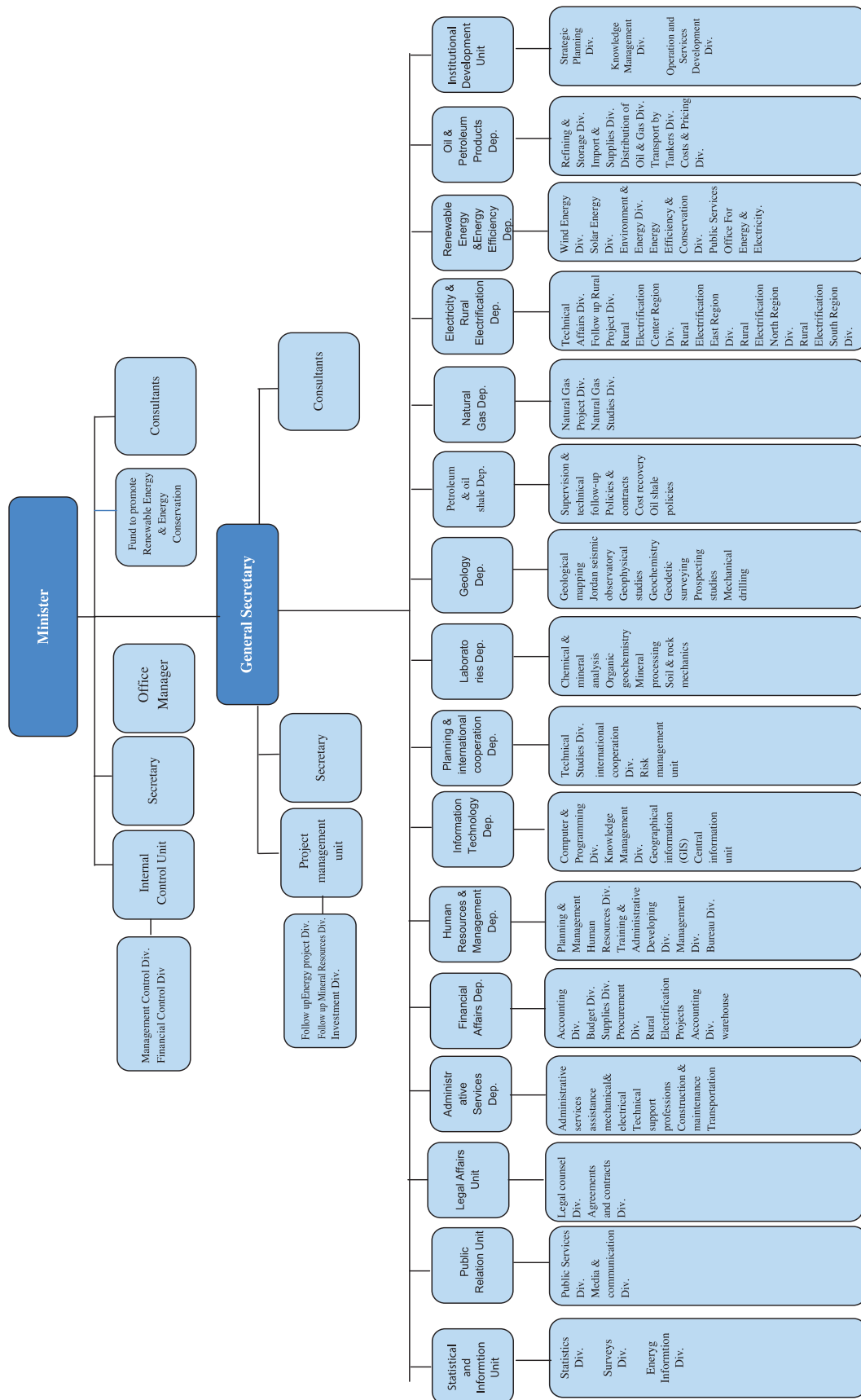
Setting and developing the appropriate policies and legislations to achieve secure sustainable supply of energy and the optimum utilization of natural resources complies with international best practices.

Core Values

- Teamwork Spirit.
- Loyalty and Affiliation.
- Integrity and Transparency.
- Excellence and Entrepreneurship.
- Knowledge Dissemination and Use.

Strategic Objectives

- Achieve a secure energy supply.
- Diversification of sources and types of energy.
- The development and utilization of conventional and renewable domestic energy sources, Oil Shale and Uranium.
- Transfer, localize, develop, sustain and improve the uses of the technology of nuclear energy.
- Increase energy efficiency in all sectors.
- Maximize the value added to utilize mineral ores.





Terms and Abbreviations

Unit	Definition
b/day	Barrel/day
boe	Barrel oil equivalent
boe/day	Barrel oil equivalent /day
CF	Cubic Feet
GDP	Gross Domestic Product
GWh	Gigawatt-hour = 10^9 Watt-hour
JD	Jordan Dinar (10^3 Fils)
kg	Kilograms
kgoe	Kilogram oil equivalent
km	Kilometer
kt	Thousand tons
kV	Kilovolt
kW	Kilowatt (10^3 Watt)
kWh	Kilowatt-hour
MVA	Mega Volt Ampere
MW	Megawatt
MWh	Megawatt-hour (10^6 Watt-hour)
toe	Ton oil equivalent





Significant Statistics of Economy in Jordan 2016

Item	Unit	Amount
Population	Million	9.8
Gross Domestic Product (GDP) at current prices	Million JD	27445
GDP per capita	JD	2801

Source: Department of Statistics

Significant Statistics of Energy in Jordan 2016

Item	Unit	Amount
Energy Intensity	kgoe/US\$1000 Fixed Price	296
Per capita energy consumption	kgoe	981
Per capita electricity consumption	kWh	1701
Electricity generation	GWh	19390
Electricity consumption	GWh	16669
Population access to electricity	% of population	99.9
Domestic energy production (crude oil and natural gas)	1000 toe	87
Energy imports	1000 toe	9740
Primary energy consumption	1000 toe	9615
Cost of consumed energy	billion JD	1.924
The Cost of Consumed Energy		
Exports	%	39.7
Imports	%	14.1
Gross Domestic Product	%	7.0



Introduction

The Ministry of Energy and Mineral Resources aims to provide all forms of energy required for sustainable development through the enhancement and implementation of proper policies, legislations and programs; diversify sources and forms of imported energy; and to boost local and renewable sources of energy and efficiency in various sectors. In this context, the Ministry of Energy and Mineral Resources and other sectors' institutions were able to accomplish many achievements during 2016.

Crude Oil and Oil Products

A continuous approach towards securing the Kingdom's need of crude oil and oil products was duly achieved. All the storage capacities projects for crude oil, oil products and liquefied petroleum gas established in Aqaba are under implementation and it is anticipated to complete the projects in 2017. The Logistic Company for Jordan Oil Facilities has been established, licensed and operated in 2016. A memorandum of understanding was signed with the marketing companies to start importing diesel in addition to importing the Kingdom's needs of gasoline (octane 95). The Ministry of Energy and Mineral Resources has followed up and supervised all relevant work to petroleum prospecting and monitored the performance of signatory companies of memoranda of understanding and production sharing agreements besides trading petroleum via submitting international tenders for oil prospecting all over the Kingdom and through energy conferences held in Jordan and abroad.

Oil Shale

The Government has given several local and international companies the concession to invest in areas of oil shale by surface, In-situ retorting and direct burning to generate electricity in addition to signing memoranda of understanding with many other companies.

Natural Gas

In order to attract a strategic partner to develop local sources of natural gas, National Petroleum Company has signed the production sharing agreement and its annexes with the IPG Company to develop the Risha field. In addition, Two LNG agreements were signed between NEPCO and Shell International Company to expand the use of natural gas at power plants and industries, and agreement between NEPCO and the Egyptian Natural Gas Holding Company to provide the Egyptian side with the surplus storage capacity of the floating gas unit FSRU. The Cabinet also approved



supplying industries with natural gas, especially LNG infrastructure industries. The Oil Products Pricing Committee had set the price of selling natural gas on monthly basis. In order to provide additional sources of natural gas, the agreement for the sale and purchase of natural gas was signed between the NEPCO and the US Company Noble Energy.

Electricity

The direct agreements were signed with the financiers of the rehabilitation project of Al Hussein thermal station and access to the successful financial closure of the project, and the commercial operation of the station is expected in the second half of 2018. A memorandum of understanding has also been signed between Jordan, represented by NEPCO and the Gulf Cooperation Council Interconnection Authority GCC, to enable the parties to initiate the preparation of technical and economic feasibility studies for the Electricity Interconnection. In order to improve the efficiency of the seventh gas unit at Al Samra power station and reduce the quantities of fuel consumed, Samra Electricity Company was assigned to convert the seventh gas turbine with a capacity of 145 MW to a combined cycle by adding a steam turbine with a capacity of 70 MW. The Chinese SEPCO was awarded the project on 25/5/2016 at a total cost of around JD 75 million. A memorandum of understanding was signed between the Ministry of Energy and the Modern Cement and Mining Company regarding the study of the construction of a 30 MW fossil fuel power station to supply the company's cement plant with the necessary electrical power.

Renewable Energy

The construction of IPP PV project Round I-direct proposals for 12 projects with a capacity of 200 MW have been achieved and commercially operated in 2016 and Thirty-four photovoltaic tenders were submitted in Round II- direct proposals to develop 4 PV projects at lowest tariff provided with a total capacity of 200 MW (50 MW each) to be expected within 2017-2018. Masdar, a clean energy developer based in Abu Dhabi, UAE, signed a Power Purchasing Agreement to build a solar power plant for a capacity of 200 MW in Muwaqqar. The project is due by 2018. The first phase of wind project to generate electricity and feed the grid with a capacity of 66 MW on EPC contract basis in Ma'an was operated. The project is funded by Kuwait Fund for Arab Economic Development and the work is in progress to implement the second phase to expand the project to 14 MW of capacity due by mid-2017. Purchase power agreements were signed with five companies to operate wind Projects- Direct Proposals-Round I with a total capacity of 330 MW due in 2017- 2018. The Ministry



announced Round III- direct proposals of renewable energy to develop 4 PV projects with a total capacity of 200 MW (50 MW for each project) and to develop two wind energy projects with a total capacity of 100 MW (50 MW for each). The sectors using small-scale renewable energy schemes reached a total capacity of 80 MW of solar systems. Consequently, NEPCO and concerned sectors succeeded hitting their savings targets.

Geology and Mining

Several areas were extensively drilled to add new areas and increase the reserves of oil shale in the Kingdom. Plenty of projects of mineral explorations were implemented and conducted to prospect, evaluate, decide the specifications, quantities, different industrial use and needs of local and external markets of various ores such as calcium carbonate, iron ores, etc.

Currently, Jordan Seismological Observatory is striven to detect, monitor and record earthquakes. Jordan Seismological Observatory JSO stations have recorded 510 earthquakes; 62 local recorded in Jordan Valley and Eastern Mediterranean regions, 116 regional and 332 distant seismic events.

The annual report shall also cover many activities and achievements that have been made to other energy sectors such as nuclear energy, mining, and rural electrification, etc.



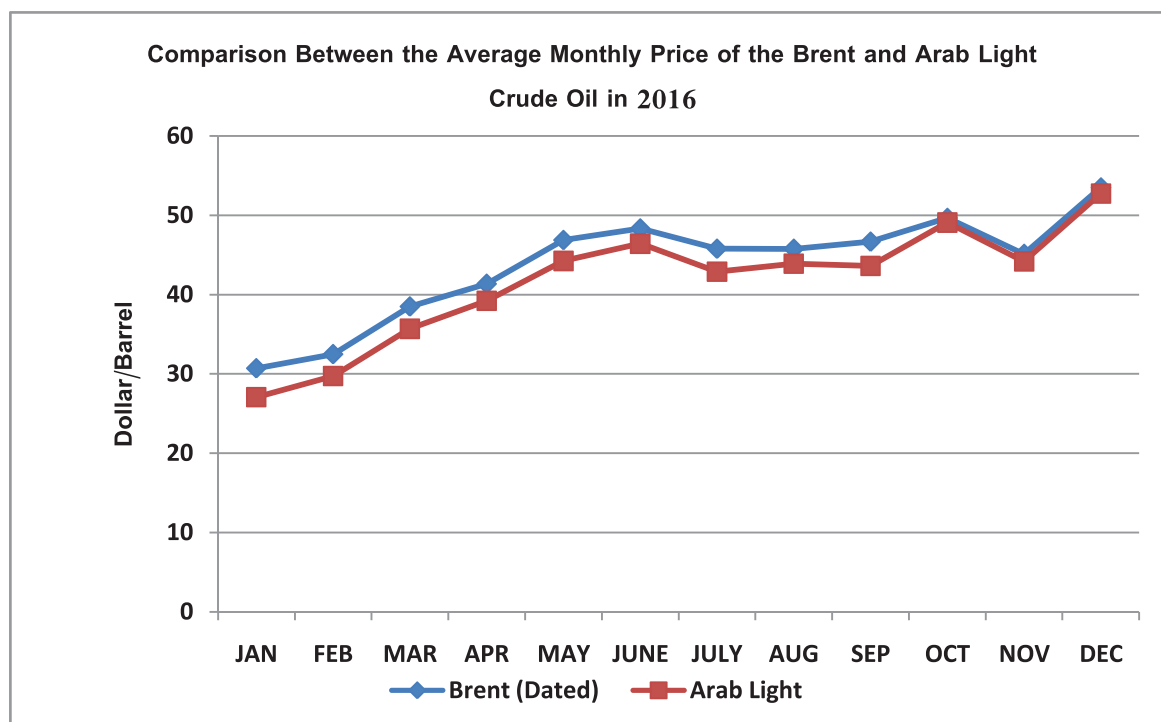
The Development of Oil and Natural Gas Sectors

First-The Arab and International Level

The average daily world production of crude oil in the year 2016 has reached around 84 million barrels showing a growth of 7% comparing to 2015. However, the world's proven reserves in 2016 scored around 1318 billion barrels.

With regard to the Arab counterpart daily production of crude oil for the same year has amounted to around 26 million barrels, a proportion of 30% of the global production. The Arab's proven reserves of crude oil for 2016 has amounted to 659 billion barrels that represents 50% of global reserves.

Brent oil prices have fluctuated and reached the highest rates at 53 dollars/ barrel in December. It hit the lowest rate at around 31 dollars/barrel in January. The following chart shows comparison of monthly average prices on Brent crude oil and Arab light imported by Jordan in 2016.



Source: Platte Bulletin

The world production of natural gas in 2016 amounted to approximately 3698 billion cubic meters with a growth estimated to 3.7% comparing with 2015 while the world's reserves stood at 197 trillion cubic meters.

On the Arab level, the Arab states' produced nearly 583 billion cubic meters of natural gas representing 16% of the world production. Yet, the Arab states' reserves of natural gas have reached nearly 54 trillion cubic meters representing 27% of the global reserves.



Second-The Local Level

The local production of energy (crude oil, natural gas and renewable energy) was around 510.4 thousand toe in 2016 representing 5% of Jordan's total energy needs. Due to the lack of energy sources, Jordan heavily depends on imports to fulfill its domestic energy needs. The imported quantities of crude oil and oil products in 2016 were amounted to approximately 5445.5 thousand toe, while No quantities of natural gas were imported from Egypt in 2016, and quantities of liquefied natural gas imported reached 4.1billion cubic meters. The total cost of crude oil and oil products, natural gas and coal imported by Jordan has reached to JD 1924 million in 2016 with a 24% of decrease comparing with 2015.

The total demand for primary energy was estimated to 9614 thousand toe in 2016 with a rise of 7% while the total demand for final energy i.e., energy available to the consumer, has reached 6646 thousand toe with a rise of 12% comparing with 2015 demand levels. On the other hand, the demand for oil products was amounted to 4783 thousand toe.



The Institutions of the Energy Sector in 2016

Given the importance of the overriding role played by energy in the socioeconomic aspects and the direct relationship to the political and economic issues; the Government has paid the sector a great attention to enhance the efficiency and effectiveness. In the light of the new institutional amendments, the current institutional framework of the energy sector comprises of the following structure:

1. The Ministry of Energy and Mineral Resources MEMR

The Ministry has adopted a comprehensive planning process for the sector in terms of regulation, policies and follow-up implementation to achieve the tasks entrusted. The most important of which is to provide the required energy by all forms needed for the purposes of comprehensive development at the lowest possible cost and better quality; beside attracting the required capital needed to invest in energy sector such as generating electricity, producing oil products, and utilizing domestic energy resources particularly the renewable ones. Not to mention supplying villages, populations and Jordanian rural communities with electricity through rural electrification. However, the Ministry spares no effort to support studies to improve energy efficiency in various sectors and ensure loan guarantee for renewable energy and energy efficiency projects through Jordan Renewable Energy and Energy Efficiency Fund JREEEF.

2. Energy and Minerals Regulatory Commission EMRC

Energy and Minerals Regulatory Commission is an autonomous corporate and the legal successor of the Electricity Regulatory Commission, the Nuclear and Radiation Regulatory Commission and the regulatory functions of the National Resources Authority with financial and administrative autonomy pursuing to the restructuring of Institutions and Government Departments law, no. 17/2014.

3. Electricity Institutions

Institutions responsible for generating, transmitting and distributing electricity all over the Kingdom as:

3.1 National Electric Power Company NEPCO

A public shareholding company owned by the government responsible for the construction, operation and maintenance of the transmission system in the Kingdom along with the electric transmission system which connects the system with other neighboring countries' systems. It also secures power supply through expansion of generating units either by the private sector and/or the public sector.



3.2 Electricity Generating Companies

3.2.1 Central Electricity Generating Company CEGCO

A public shareholding company founded in 1999 generates electricity and sells electricity in wholesale to the National Electric Power Company. The generating capacity of the company has amounted to 1392 MW at the end of 2016.

3.2.2. Samra Electric Power Company SEPCO

A private shareholding company founded in 2004 and whose shares are fully owned by the government. The company is responsible to generate electricity and sell it to NEPCO. The generating capacity of the company reached around 1059 MW at the end of 2016.

3.2.3.AES-Jordan. PSC

Also known as Amman East Power Project, a private company owned by the American AES company and the Japanese MITSUI company founded in 2009. It generates and sells electricity to NEPCO. AES-Jordan. PSC owned the first private project to generate electricity in East Amman power plant/Al-Manakher which was inaugurated under the patronage of His Majesty King Abdulla II on 26th, Oct.2009. The generating capacity of the company reached around 373 MW at the end of 2016.

3.2.4. Qatraneh Electric Power Company

A private company owned by the Korean KEPCO company and the Saudi XENEL company founded in 2010. The company generates and sells electricity to NEPCO. The generating capacity of the company Amounted to around 373 MW by end of 2016.

3.2.5 Amman Asia Electric Power Company

A private company established in 2014 by the Korean KEPCO Company and the Japanese Mitsubishi. The company produces and generates around 570 MW of electricity capacity in 2016 and sells electricity to National Electricity Power Company NEPCO.

3.2.6 AES LEVANT HOLDING B.V/JORDAN

A private company established in 2014 by the Korean KEPCO Company and the Japanese Mitsubishi. The company produces and generates around 240 MW of electricity capacity in 2015 and sells electricity to National Electricity Power Company NEPCO.

3.2.7 Jordan Wind Project Company PSC, JWPC

A co-development consortium between InfraMed 50%, Masdar 31% and EP Global Energy 19%. JWPC produces approximately 400 GWh of electricity annually and displace 235,000 tons of CO2 emissions per year. The company has completed a



construction of IPP Project-direct proposals and started commercial operation in 2015 with a capacity of 117 MW in Tafilah. JWPC now sells electricity to National Electricity Power Company NEPCO.

3.3. Electricity Distribution Companies

Includes three companies, each has a concession area to distribute electricity as follows:

3.3.1. Jordan Electric Power Company JEPCO

A 20-year licensed public shareholding company which was given license in 29.5.2014. JEPCO is responsible for distributing electricity in Zarqa, Ma'daba and Balqa governorates excluding Central Jordan Valley.

3.3.2. Irbid District Electricity Company LTD IDECO

A public shareholding company responsible for distributing electricity in Irbid, Mafraq, Jerash and Ajloun governorates excluding Northern Jordan Valley and Eastern areas. The company has been granted a 25-year license in 2008.

3.3.3. Electricity Distribution Company EDCO

A public shareholding company responsible for distributing electricity outside the concession areas of JEPCO and IDECO; namely the Southern, Eastern and Jordan Valley areas. The company had been granted a 25-year license in 2008.

4. Petroleum, Gas, and Mineral Ores Institutions

Institutions carry out operations of prospecting oil, gas and mineral ores inside the Kingdom along with refining and selling crude oil and oil products. The institutions include:

4.1. National Petroleum Company NPCO

A public company owned by the government. NPCO prospects oil and gas in the concession area to the northeast of the Kingdom along with the Iraqi borders covering an area of 7000 square kilometers including Risha gas field within an area around 1500 square kilometers. The duration of the concession period lasts for 50 years from the date of entry into force in 1996.

4.2. Jordan Petroleum Refinery Company JPRCO

A public shareholding company responsible for refining producing and distributing crude oil and oil products inside the Kingdom by service agreements signed with MEMR and have been extended several times.

4.3. Jordanian Egyptian Fajr for Natural Gas Transmission & Supply Co. Ltd

A limited liability company, pursuant to the Jordanian Companies Law and License Agreement signed on 25.1.2004 by both Jordan government represented by the Ministry of Energy and Mineral Resources and Jordanian Egyptian Fajr. It builds,



operates and owns the gas pipeline from Aqaba to the north of Kingdom. Moreover, it collects the Egyptian natural gas in Aqaba through the pipeline, transfers and sells it to the power plants and major industries.

4.4. Gas Stations

Stations owned by legal or natural persons concerns with selling fuel. The number of the stations operated in the region reached 518 stations at the end of 2016.

4.5. LPG Agencies

Agencies owned by legal or natural persons concerns with distributing gas cylinders. The number of working agencies reached 1176 stations at the end of 2016.

4.6. LPG Warehouses

Warehouses owned by legal or natural persons distribute and transfer LPG cylinders from filling stations to warehouses and provide licensed distribution agencies. The number of warehouses has reached 126 warehouses at the end of 2016.

4.7. Central LPG Distribution Companies

Privately-held companies concerns with distributing LPG by tanks. The number of the companies reached 6 companies in 2016.

4.8. Oil Products Marketing Companies

Three privately-held companies concerns with distributing oil products (gasoline, diesel, kerosene and jet fuel).

5. Jordan Atomic Energy Commission

Jordan Atomic Energy Commission was established at the beginning of the year 2008. The work of the Atomic Energy Commission focuses on introducing the peaceful uses of nuclear energy and radiation to the Kingdom and developing its sustainable use to generate electricity, desalinate water and various applications of agriculture, medicine and industry purposes.

6. Jordan Bio-Gas Company Ltd.

A joint-stock company owned by the CEGCO and Greater Amman Municipality GAM founded in 1998. The Company aims at converting organic waste into methane gas to generate electricity. The generating capacity reaches 3.5 MW.



The Energy Sources in Jordan

Jordan local energy sources of oil and natural gas are very limited despite the exerted efforts spent by the government to develop, search, or prospect for other domestic resources through foreign companies associated with the government. Those companies have offered all required facilities and information provided by seismic studies and surveys.

Jordan has a huge amount of oil shale which exceeds 70 billion tons containing more than 7 billion tons of oil. Oil shale may be burned directly to generate electricity. Furthermore, ICP technology and surface retorting may be used to produce gas and shale oil.

In connection with the contribution of renewable energy resources to the total energy mix, it does not exceed 5%. The Ministry of Energy and Mineral Resources has adopted an ambitious program to increase the contribution of renewables the total energy mix to reach 10% by 2020.

All details related to domestic energy resources will be subsequently discussed while pointing out to the comprehensive strategy of the energy sector.

Table 1 shows the domestic production of crude oil and natural gas and their contribution to the overall energy consumed during 2012-2016 in the Kingdom.

Table (1)

Domestic Production of Crude Oil and Natural Gas during 2012-2016

Year	Crude Oil (kt)	Natural Gas (BCF)	Contribution of Domestic Production of Oil and Natural Gas to the Overall Energy Consumption (%)
2012	1.0	5.8	2.4
2013	1.0	5.3	2.1
2014	0.8	4.6	3.0
2015	0.5	4.3	3.0
2016	0.4	4.1	5.0



The Domestic Demand for Energy and Electricity

1. Crude Oil and Oil Products

The cost of crude oil and oil products imports in 2016 was estimated to JD 1333 million registering a decrease of 34 % comparing with 2015.

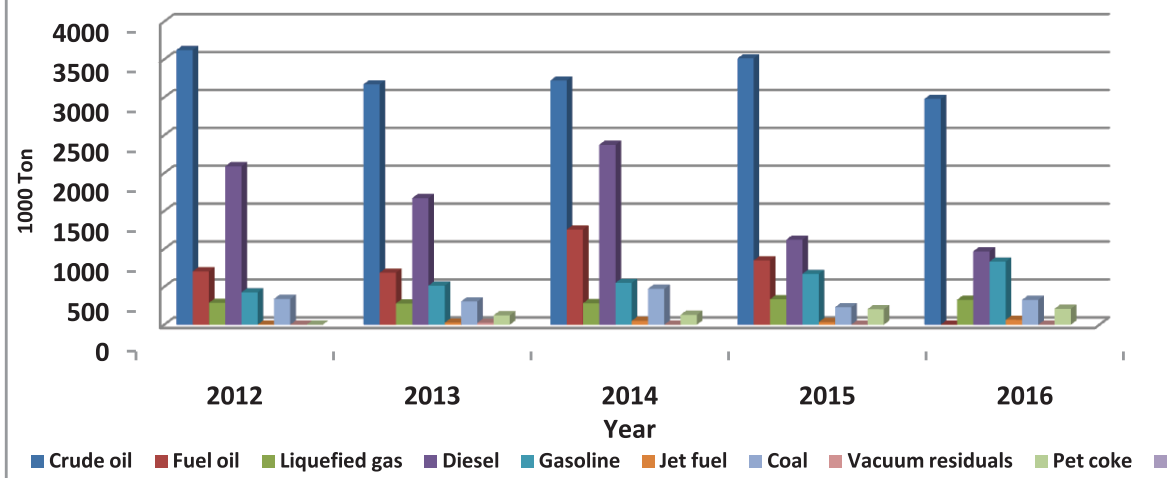
Table 2 shows the quantity of crude oil and oil products imports during 2012-2016.

Table (2)

Imports of Crude Oil and Oil Products during 2012-2016 (thousand ton)

Year	Crude oil	Fuel oil	Liquefied gas	Diesel	Gasoline	Jet fuel	Coal	Vacuum residuals	Pet coke	Total
2012	3623	703	288	2089	426	1	340	-	-	7130
2013	3170	685	280	1670	515	27	306	23	123	6799
2014	3221	1255	282	2373	552	51	474	0	130	8338
2015	3513	848	335	1121	670	34	230	0	204	6955
2016	2978	0	327	967	832	64	327	0	210	5705

Import of Crude Oil, Oil Products, Coal, Coke





2. Natural Gas

No quantities of natural gas were imported from Egypt in 2016. The quantities of liquefied natural gas (LNG) from floating gas vessels reached about 4.1 billion cubic meters.

3. Primary and Final Energy Consumption

The overall demand for primary energy in 2016 was nearly 9614 thousand toe with 7 % of increase comparing with 2015.

Table 3 demonstrates the domestic demand for primary energy during 2012-2016.

Table(3)

Primary Energy Consumption during 2012-2016 (Thousand toe)

Year	Type of primary energy						Total
	Crude Oil and Oil Products	Coal	Pet Coke	Natural Gas	Renewable Energy	Imported Electricity	
2012	6992	226	-	659	140	188	8205
2013	6689	204	116	907	145	96	8157
2014	7479	332	88	301	152	109	8461
2015	6331	161	165	1944	160	183	8944
2016	5327	220	182	3389	412	84	9614

As for final energy consumption and distribution to all economic sectors are shown in table 4.

Table (4)

Sectorial Distribution of Final Energy Consumption during 2012-2016 (thousand toe)

Year	Sector				Total
	Transport	Industry	Household	*Others	
2012	2521	921	1198	743	5383
2013	2734	924	1109	617	5384
2014	2558	1079	1152	718	5507
2015	2811	991	1272	754	5828
2016	3184	1064	1342	826	6416

*Includes commercial and agricultural sectors along with street lights.

Table 5 shows the percentages of the sectorial distribution of final energy.

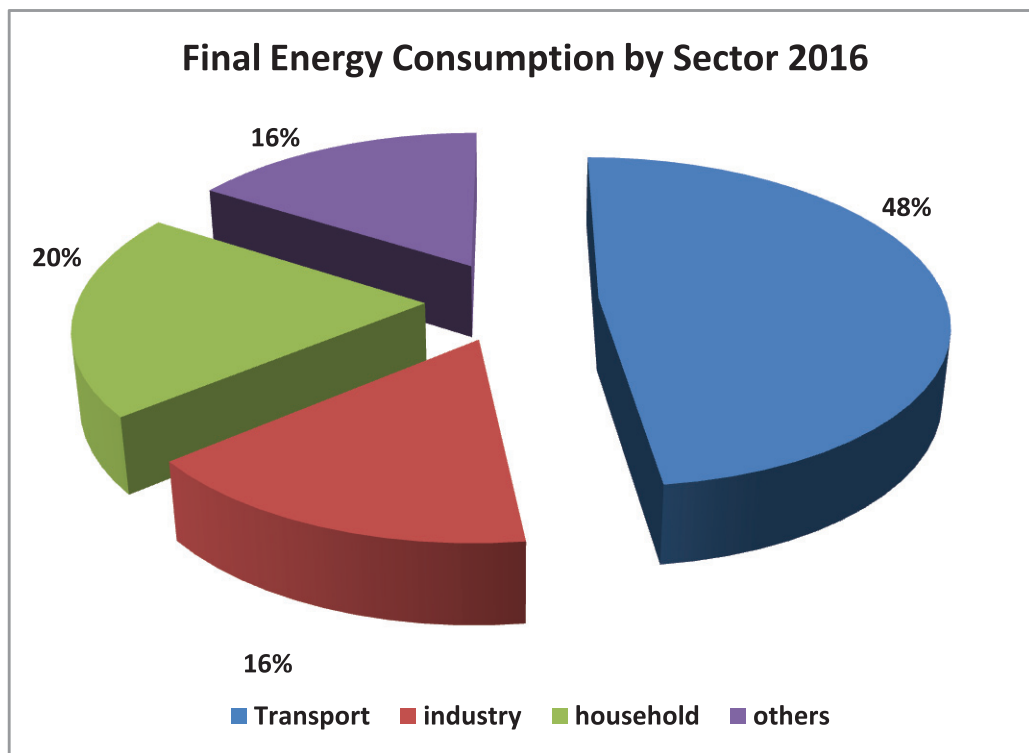


Table (5)

Percentages of Sectorial Distribution of Final Energy Consumption during 2012-2016

Year	Sector				Total %
	Transport	Industry	Household	Others *	
2012	47	17	22	14	100
2013	51	17	21	11	100
2014	46	20	21	13	100
2015	48	17	22	13	100
2016	48	16	20	16	100

*Includes commercial and agricultural sectors along with street lights.





4. Oil Products Consumption and Prices

In general, the year 2016 had witnessed decrease of around 21 % in the consumption of oil products due to the decrease demands of oil products used in electricity generation and large imported quantities of natural gas. The decrease of consumption amounted to 64% and 23% for fuel oil and diesel respectively. The consumption of oil products has amounted to around 4912 thousand tons comparing with 6272 thousand tons in 2015.

Table 6 shows development in the production of oil products during 2012-2016. Meanwhile, table 7 shows development in the consumption of oil products for the same period.

Table (6)

Development of Jordan Petroleum Refinery's Production of Oil Products during 2012-2016 (Thousand ton)

Oil Products Year	Liquefied Gas	Gasoline	Jet Fuel	Kerosene	Diesel	Fuel Oil	Asphalt	Total
2012	102	716	357	96	1109	999	97	3476
2013	78	663	325	34	980	900	101	3082
2014	91	634	318	63	930	812	160	3008
2015	80	653	257	91	1058	885	188	3212
2016	81	583	287	97	909	599	238	2794

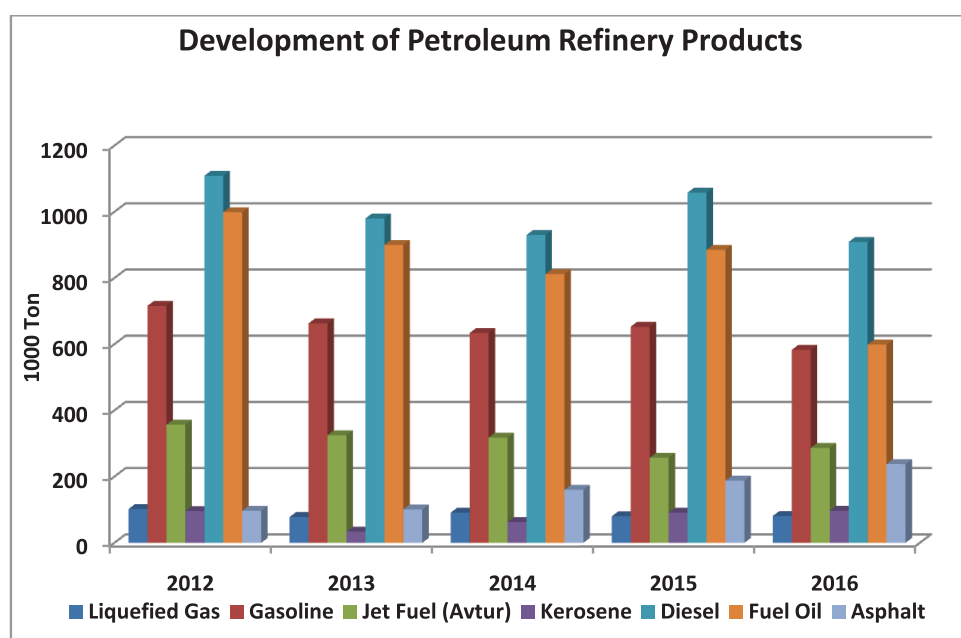


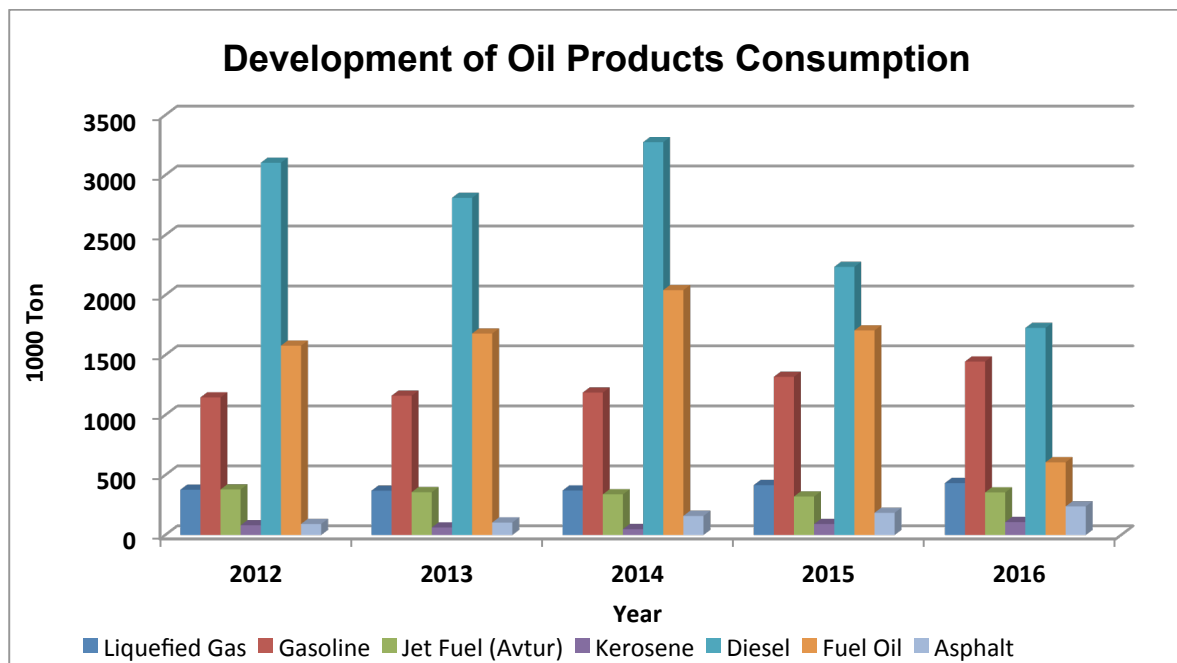


Table (7)

Development of Oil Products Consumption during 2012-2016 (Thousand ton)

Oil Product Year	Liquefied Gas	Gasoline	Jet Fuel	Kerosene	Diesel	Fuel Oil	Asphalt	Total
2012	377	1147	380	81	3103	1578	92	6758
2013	369	1161	357	63	2810	1679	104	6544
2014	371	1187	339	49	3274	2041	159	7420
2015	416	1319	321	91	2235	1705	185	6272
2016	433	1446	355	108	1726	606	238	4912
Growth Rate %	4	10	11	19	(23)	(64)	28	(21)

*Where brackets around numbers signifies a negative amount.





As for oil products prices in 2016, a policy towards liberating oil products prices was reinstated starting from 14.11.2012 according to global pricing policy after a stop in early 2011. A monthly pricing formula was applied on most oil products.

The following table demonstrates the prices of oil products announced locally in 2016.



Table (8) - Local Prices of Oil Products 2016

Item	Unit	Jan.	Feb.	Mar.	Apr.	May	June		Jul	Aug.	Sept.	Oct.	Nov.	Dec.
							1-22	22-30						
Gasoline (90)	Fils/Litre	520.00	495.00	495.00	525.00	535.00	560.00	580.00	580.00	555.00	555.00	575.00	600.00	580.00
Gasoline (95)	Fils/Litre	680.00	650.00	650.00	695.00	705.00	730.00	745.00	745.00	720.00	720.00	745.00	780.00	755.00
Kerosene	Fils/Litre	360.00	320.00	320.00	355.00	365.00	405.00	440.00	440.00	425.00	425.00	435.00	455.00	435.00
Diesel	Fils/Litre	360.00	320.00	320.00	355.00	365.00	405.00	440.00	440.00	425.00	425.00	435.00	455.00	435.00
Diesel/Ship	Fils/Litre	380.00	395.00	400.00	385.00	385.00	405.00	440.00	440.00	425.00	425.00	435.00	455.00	435.00
Liquefied Gas 12.5kg	JD/Cylinder	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Liquefied Gas 50kg	JD/Cylinder	32.77	29.39	28.00	28.00	28.00	29.00	28.25	28.25	28.00	28.00	28.00	28.63	31.00
Liquefied Gas/Central Distribution/ Bulk	JD/ton	614.32	546.86	500.64	530.00	530.00	533.11	526.43	526.43	499.12	477.95	495.40	533.83	579.48
Fuel Oil/Industry	JD/ton	200.00	177.67	179.62	207.49	217.01	241.38	251.69	251.69	255.59	253.82	264.08	275.80	272.50
Fuel Oil/ Electricity	JD/ton	145.65	128.90	135.70	171.62	183.71	196.35	204.04	204.04	192.28	192.15	195.72	209.20	189.06
Fuel Oil 1% Sulpher	JD/ton	233.33	212.99	214.94	242.81	252.33	276.69	287.01	287.01	290.91	289.14	299.39	319.78	313.63
Fuel Oil/Ships	JD/ton	200.00	177.67	179.62	207.49	217.01	241.38	251.69	251.69	255.59	253.82	264.08	284.46	278.32
Avtur/Local	Fils/Litre	300.00	255.00	265.00	295.00	305.00	330.00	347.00	347.00	332.00	326.00	332.00	359.00	340.00
Avtur/Foreign	Fils/Litre	305.00	260.00	270.00	300.00	310.00	335.00	352.00	352.00	337.00	331.00	337.00	364.00	345.00
Avtur/Charter	Fils/Litre	320.00	275.00	285.00	35.00	325.00	350.00	367.00	367.00	352.00	346.00	352.00	379.00	360.00
Asphalt	JD/ton	220.00	194.90	203.78	231.65	241.17	265.54	275.85	275.85	279.75	277.98	288.24	308.62	302.48



5. The Electricity

The demand for electricity had increased and reached 3% in 2016. The highest rate recorded by household and street lights and reached 7%, 4% respectively. The overall amount of electricity imports through interconnection network with Egypt and Syria reached 334 GWh registering a decrease of 45% comparing to year 2015. The Ministry of Energy and Mineral Resources and the National Electricity Power Company made several actions to meet the growing demand. The details of mentioned procedures will be described later on while viewing the overall strategy for the energy sector.

- Electricity Generation and Consumption

The volume of electricity generated in 2016 reached 19390 GWh registering a growth of 2.5% of that in 2015 while the electricity consumed for the same period reached 16669 GWh recording a growth of 3% approximately comparing with that in 2015. However, the Peak load of the electricity system has recorded 3250 MW in 2016 pointing a decrease of 1 % compared to that in 2015.

The following tables 9, 10 and 11 demonstrate the development of production and consumption of electricity as well as the distribution of the consumption and the rate across sectors.

Table (9)

Growth of Electricity Production and Peak Load during 2012-2016

Year	Peak Load MW	Growth Rate %	Electricity Generated GWh	Growth Rate %
2012	2880	3.2	16595	13.3
2013	3100	7.6	17261	4.0
2014	3020	(2.5)	18704	8.4
2015	3300	9	18911	1
2016	3250	(1)	19390	2.5

*Where brackets around numbers signifies a negative amount.

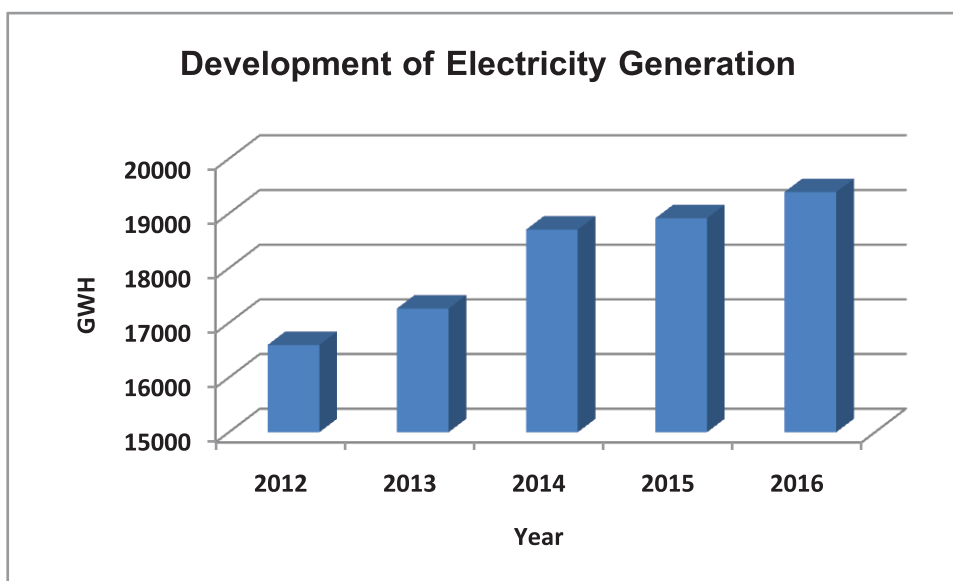
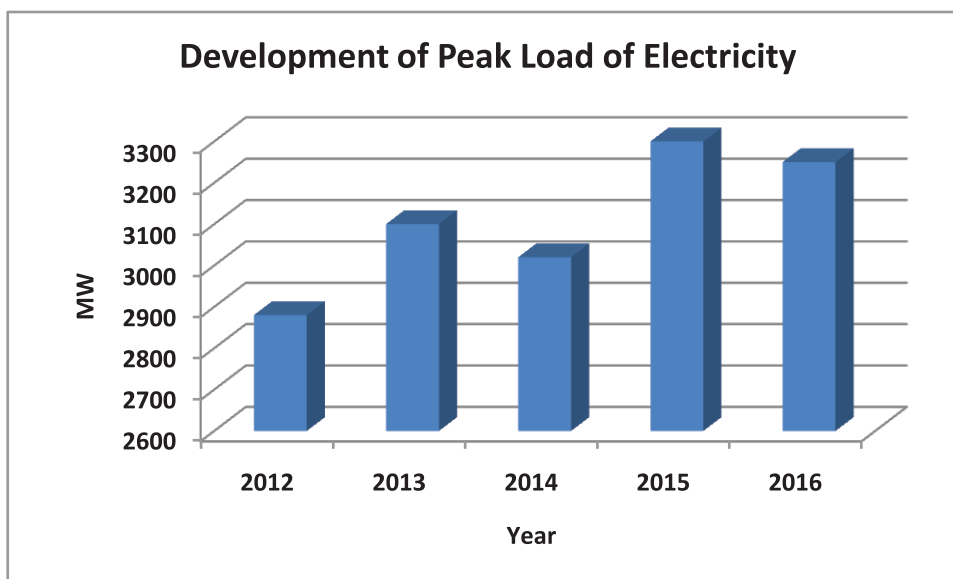


Table (10)

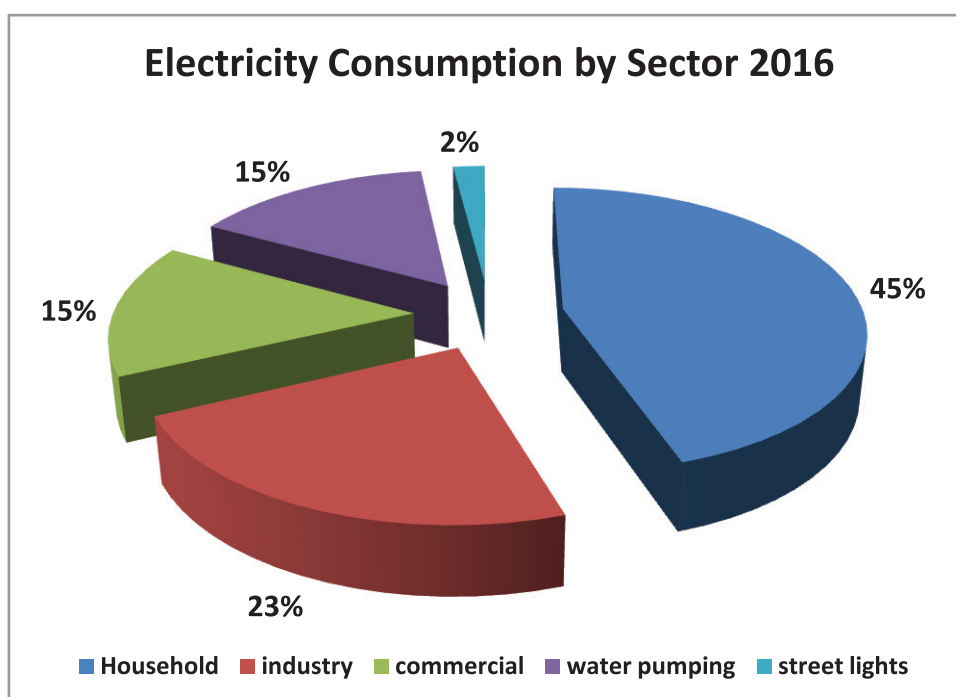
Sectorial Distribution of Electricity Consumption and Growth Rate during 2012-2016 (GWh)

Sector Year	Household	Industry	Commercial	Water Pumping	Street Lights	Total	Growth Rate %
2012	6126	3461	2427	1955	305	14274	5.5
2013	6265	3517	2415	2076	291	14564	2.0
2014	6580	3877	2358	2287	316	15418	5.9
2015	6938	4013	2460	2426	336	16173	5
2016	7448	3939	2447	2485	350	16669	3

**Table (11)**

Percentages of Sectorial Consumption of Electricity during
2012-2016

Sector Year	Household	Industry	Commercial	Water Pumping	Street Lights	Total %
2012	43	24	17	14	2	100
2013	43	24	17	14	2	100
2014	43	25	15	15	2	100
2015	43	25	15	15	2	100
2016	45	23	15	15	2	100



- The Electricity Tariff

Electricity tariffs sold by NEPCO to the distribution Companies and major subscribers in 31.12.2016 are demonstrated in the following table:



Table (12)

Electricity Tariffs Applicable in the Kingdom Issued on November 1st, 2016

Electricity Tariff sold by NEPCO to the Electricity Distribution Companies:	Unit	Tariff Value
A. JEPCO		
• Peak Load	JD/kW/Month	2.98
• Day-time Supply	Fils/kWh	76.97
• Night-time Supply	Fils/kWh	66.92
B. EDCO		
• Peak Load	JD/kW/Month	2.98
• Day-time Supply	Fils/kWh	72.46
• Night-time Supply	Fils/kWh	62.39
C. IDECO		
• Peak Load	JD/kW/Month	2.98
• Day-time Supply	Fils/kWh	62.79
• Night-time Supply	Fils/kWh	52.74

Table 13 below shows the electricity tariffs sold by the distribution companies to consumers in 31.12.2016.

Table (13)

Electricity Tariffs sold by the Distribution Companies to Consumers

Consumer	Unit	Value
A. Household Users		
• First Block: 1-160 kWh per month	Fils/kWh	33
• Second Block: 161-300 kWh per month	Fils/kWh	72
• Third Block: 301-500 kWh per month	Fils/kWh	86
• Fourth Block: 501-600 kWh per month	Fils/kWh	114
• Fifth Block: 601 -750 kWh per month	Fils/kWh	158
• Sixth Block: 751-1000 kWh per month	Fils/kWh	188
• Seventh Block: More than 1000 kWh per month	Fils/kWh	265



B. Ordinary Users	• First Block: 1-160 kWh per month	Fils/kWh	42
	• Second block: 161-300 kWh per month	Fils/kWh	92
	• Third Block: 301-500 kWh per month	Fils/kWh	109
	• Fourth Block: 501-600 kWh per month	Fils/kWh	145
	• Fifth block: 601-750 kWh per month	Fils/kWh	169
	• Sixth Block: 751-1000 kWh per month	Fils/kWh	190
	• Seventh Block: More than 1000 kWh per month	Fils/kWh	256
C. Radio and TV Broadcasting Stations-Flat Rate Tariff		Fils/kWh	173
D. Commercial Users	• First Block: 1-2000 kWh per month	Fils/kWh	120
	• Second Block: More than 2000 kWh per month	Fils/kWh	175
E. Banks		Fils/kWh	285
• Flat Rate Tariff			
F. Telecommunication	• First Block: 1-2000 kWh per month	Fils/kWh	230
	• Second Block: More than 2000 kWh per month	Fils/kWh	273
G. Small Industries – Flat Rate Tariff		Fils/kWh	71
• First Block: 1-10.000 kWh per month		Fils/kWh	81
	• Second Block: More than 10.000 kWh per month		
H. Medium Industries	• Peak Load	JD/kW/Month	2.0
	• Day-time Supply	Fils/kWh	89
	• Night-time Supply	Fils/kWh	75
I. Agriculture- Flat Rate Tariff		Fils/kWh	60



J. Agriculture- Three Part Tariff		
	• Peak Load	JD/kW/Month 3.79
	• Day-time Supply	Fils/kWh 59
	• Night-time Supply	Fils/kWh 49
K. Water Pumping.	Fils/kWh	94
L. Hotels- Flat Rate Tariff	Fils/kWh	91
	• Peak Load	JD/kW/Month 3.79
	• Day-time Supply	Fils/kWh 89
	• Night-time Supply	Fils/kWh 75
M. Street lighting- Flat Rate Tariff	Fils/kWh	114
N. Armed Forces- Flat Rate Tariff	Fils/kWh	146
O. Ports Corporation- Flat Rate Tariff	Fils/kWh	159
P.Large Industry First: Mining Extractive Industries		
	• Peak Load	JD/kW/Month 2.98
	• Day-time Supply	Fils/kWh 237
	• Night-time Supply	Fils/kWh 170
	Second: Other Industries	
	• Peak Load	JD/kW/Month 2.98
	• Day-time Supply	Fils/kWh 124
	• Night-time Supply	Fils/kWh 109
Q. Mixed (Commercial/Agriculture)		
	• Tow Third of Consumption	Fils/kWh 120
	• Last Third of Consumption	Fils/kWh 60

-The Rural Electrification

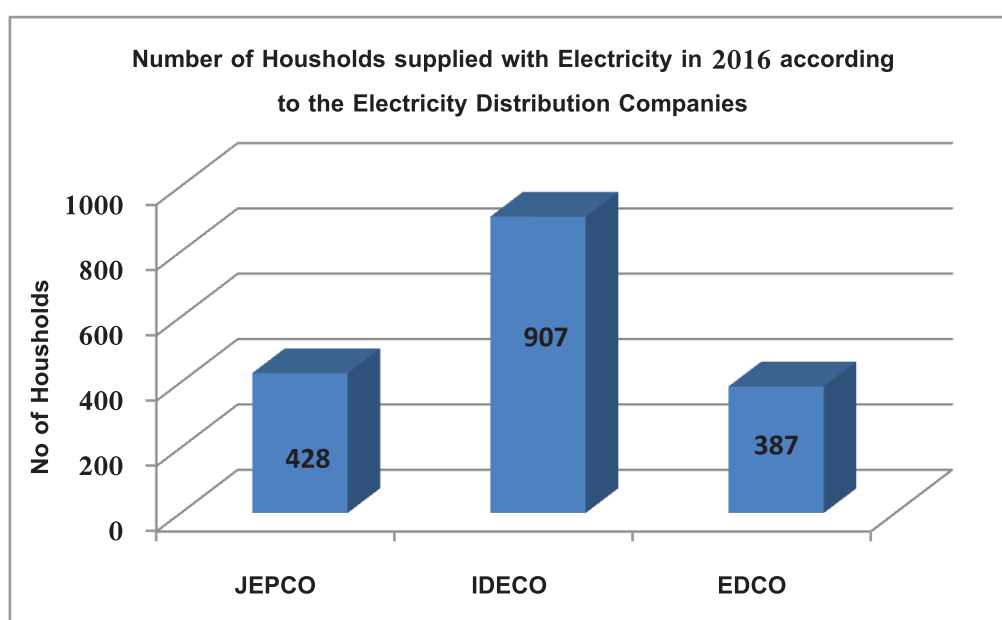
The Ministry of Energy and Mineral Resources has continued electrification to remote villages, rural communities and poor families in 2016. The total recorded requests for electrification was 2362 at an estimated cost amounted to JD 12.247 million. Requests were handled as described in table 14, which also shows the cost for each category based on the total cost estimates required by all applications amounting to JD 12.247 million.

The following figures illustrate the number of houses electrified in 2016 recording 1722 houses distributed by areas under concession of the electricity distribution companies.

**Table (14)**

Classification of processed sites in 2015 and cost of each category of estimated total cost

Implemented Sites		Cancelled Sites		Rejected Sites		Approved Sites	
No.	Cost million JD	No.	Cost million JD	No.	Cost million JD	No.	Cost million JD
1439	4.072	117	0.758	522	5.068	1840	7.179
Cost%	33	6		42		58	



The Council of Ministers has approved to provide electricity for some projects at the expense of rural electrification. The decision aims at contributing to CBOs development, create jobs, reduce poverty, unemployment and support both the agricultural and tourism sectors. The total value of the projects was amounted to around JD 808.680 in 2016. The projects included areas like farms located in the north and south of Mujib Dam, Wala-Hidan Valley, Mkawer archaeological site, Al Mawa Wildlife Reserve, children's park in Tafil, Al-Mujib Biosphere Reserve Center, Armed Forces, Green Fodder for the Al-Khair Cooperative Society, Al-Darwish Waste Landfill, and the Royal Academy for Nature Conservation Training Center in Ajloun Governorate, which contributes to providing the Kingdom with qualified international and local experts in nature protection. Environmental tourism and inspection and protection services. As well as the building of the Association of Sons of Karak and Tafil, Al-Fardakh Sports Club, Maeen Club and Municipal Stadium in the Municipality of Geeza.



Significant Accomplishments in Energy and Mineral Resources - 2016

The Ministry of Energy and Mineral Resources alongside with other energy institutions have sustained the action plan for 2016 emerged from the Executive Development Program along with the overall energy strategy.

Outlined below are the accomplishments of the Ministry.

Crude Oil and Oil Products

1. Projects of Oil Sector

To follow-up the following projects:

- Building storage capacities of crude oil and oil products estimated to 100 thousand tons in Aqaba, expected during the third quarter of 2017.
- Building storage capacities of liquefied petroleum gas estimated to 6 thousand tons in Aqaba, expected during the third quarter of 2017.
- Building 250-300 thousand tons strategic capacities of oil products and 8000 tons of LPG in the middle of the Kingdom, expected during the third quarter of 2017.
- Development of LPG port to construct a gas pipeline implemented by Aqaba Development Corporation ADC in 1/3/2015.
- Building Iraq-Jordan pipeline to import crude oil from Iraq to the port of Aqaba. A framework agreement was signed and deemed effective in 22.4.2013.

2. Crude Oil and Oil Products

- Establishment of the Logistic Company for Jordan Oil Facilities-Joint stock Company started in 17/8/2015.
- Ongoing discussion to import Iraqi crude oil via Jordan territories
- Progression of Jordan Petroleum Refinery Company fourth expansion project.
- Study energy investor's requests to construct new refineries.
- Sign a memorandum of understanding with the marketing companies to import processed diesel for a trial period of 6 months from May-October 2016 on 4/1/2016.
- Coordination with oil marketing companies to import the full amount of the deficit of diesel production of the refinery in addition to the needs of the Kingdom of unleaded gasoline 95 Octane from abroad from December 2016.

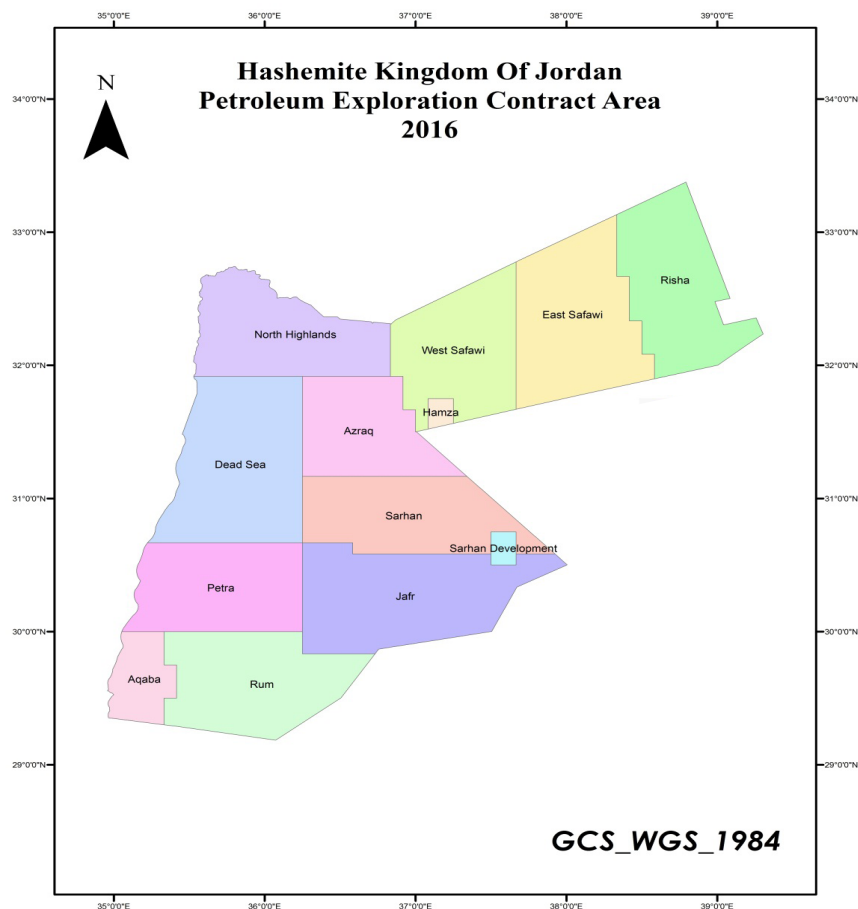


- Monitor and observe prices of crude oil and oil products data according to Platts' daily spot price assessment and required by the oil pricing committee to determine oil prices in local market besides preparing monthly pricing schedules for oil products and follow-up Jordan Petroleum Refinery Company financial statements and marketing companies' activities.
- Grant four licences to cement factory companies to import 200 thousand tons of pet coke, 35 thirty-five operating licences to new gas stations, 62 permits to start LPG agencies, 2 licences to operate LPG small cylinders storage areas and 500 permits to operate central LPG facility.

Energy Domestic Resources – Natural Gas & Oil

The Ministry of Energy and Mineral Resources MEMR supervises all prospecting and exploiting works of petroleum (oil and gas). It also monitors the performance of signatory companies of memoranda of understanding and production sharing agreements. The Kingdom has been divided to ten exploratory areas and two development areas in terms of the subsurface geological features performed in 2D and 3D seismic surveys.

The petroleum possibilities are shown in the figure below:



The Ministry has worked on multi-faceted approaches in 2016



First: Petroleum Agreements

- Risha Well

The Ministry follows up the Concession Agreement with the National Petroleum Corporation for a period of 50 years from 1996 to 2046. The daily production has amounted to around 11.2 million cubic feet during 2016 with total cumulative amounted to 213.7 trillion cubic feet by end of 2016. All quantities produced supplies the power plant in the Risha field and contributes with around 1.3 % of the Kingdom's needs of electricity. However, the natural gas quantity produced has amounted to 4.11 trillion cubic feet with the total value of JD 5.8 million.

- East Safawi-9459 km²

The Ministry follows-up a production-sharing agreement alongside with the National Petroleum Company already issued by a special law No. 14/2014 on 01/04/2014.

- Hamza Oil Field-100 km²

The Ministry follows-up and starts activating a development and production agreement issued by a special law No. 29/2015 on 16/06/2015 alongside with Transeuro Energy Corporation. The Ministry currently monitors Hamza oil field production and shipment to the Jordan Petroleum Refinery.

- Al-Jafr & Central Jordan Blocks-17,420 km²

The Ministry follows up and starts activating a production sharing agreement with the Canadian Ammonite Energy International Inc. issued by a special law No. 25/2015 on 2/6/2015.

Second: Marketing Petroleum Regions

In cooperation with the British company CGG, The Ministry of Energy has worked on rezoning oil exploratory areas and re-evaluating available information based on advanced scientific basis. The project was completed in December 2016 and the attached figure above is adopted officially now for marketing purposes.

The Ministry has also participated in the Energy Summit held in May 2016 in Amman by displaying and marketing open contract petroleum areas.

Third: Other Projects

- Update CIU

Introduce new programs and softwares compatible with the petroleum input and output database. The Ministry has signed a memorandum of understanding with the University of Freiburg in Germany to digitize all data and information, evaluate some open contract petroleum areas and study the storage of shale gas in Jordan.



- Space Information Management System SIMS

Categorize and document 873 boxes to be inserted to the SIMS. The information will be passed over to CIU and saved to online data room.

Oil Shale

Jordan's oil reserves are the fourth largest in the world with more than 70 billion tons of proven surface reserves, apart from huge quantities of deep crude reserves ten times higher than the surface oil shale.

National Energy Strategy has included oil shale as an alternative energy source with 12 % of energy mix estimation by 2020.

Oil shale can be exploited through:

- Retorting deep oil shale to produce oil.
- Retorting surface oil shale to produce oil.
- Direct combustion to generate electricity

The Ministry of Energy and through the 3rd International Oil Shale Symposium (3rd JIOSS) and the 36th CSM Symposium held in Jordan has discussed and evaluated global and domestic developments and challenges in the oil shale investments gathering key players in the energy industry in oil shale and provided the necessary equipment for implementation and preparation of instructive maps of all oil shale areas studied and proposed for exploration besides processing packages for investment purposes.

Memoranda of understanding signed for shale ore in Jordan

- Monthly follow-up to companies' excavation programs and studies.
- Follow-up relinquishment of pre-economic feasibility.

Signed MOUs

- Global Oil Shale Holdings GOSH
- Whitehorn Resources, Inc.
- Fushun Mining Group
- Al Qamar for Energy & Infrastructure Ltd.
- Questerre Energy Jordan Corporation.
- El-Lujjon Company
- National Oil & Electricity from Oil Shale Company JOSECO.

Signed concession agreements in Jordan

- Jordan Oil Shale Company JOSCO
Utilize deep oil shale ores and follow-up the experimental station initiated on 29/9/2015.
- Karak International Oil Company KIO
Surface retorting technology and follow up KIO contractual obligations in prospecting for oil shale.



- Saudi Arabian Corp for Oil Shale SACOS

Surface retorting technology and follow up SACOS contractual obligations in prospecting for oil shale.

- Jordan Oil Shale Energy Company

Surface retorting technology and follow up company's contractual obligations in prospecting for oil shale and relinquish part of the concession area in favor of direct burning project.

Oil Shale Direct Burning Projects to Generate Electricity

The Estonian /Malay/ Jordanian Attarat Power Company

- The Attarat Power Company (APCO) Consortium Eesti Energia, YTL Power International Berhad (YTL) and Yudean Group (Yudean) to construct the first oil shale fired power station located at the Attarat um Ghudran. The construction of the 470 MW oil shale fired power station is scheduled to start operation in mid-2020.

- APCO discussed with Bank of China (BoC) and Industrial and Commercial Bank of China (ICBC) to provide debt funding for the project. The USD 2.2 billion debt financing is expected to be provided by China Export & Credit Insurance Corporation and achieving financial close by 2016.

- Agreements signed with APCO has included the executive agreement, direct executive agreement, Key stakeholder agreement, land lease agreement, mining agreement, power purchase agreement, national grid agreement and direct agreement

Other Companies

The Cabinet has opened a negotiation with number of international companies showing an interest in tendering direct burning oil shale for generating electricity. The Enefit consortium of Thanya for energy and mining and Chinese CEMC, Dongfang Boiler Group Co., Ltd., China Railway Construction 19th Bureau Group Co., Ltd. has provided a tender to generate 900 MW of electricity out of direct burning in El-Lajjun at beginning of 2021 to be studied by NEPCO in accordance with electrical system in the Kingdom.

The Renewable Energy

Undoubtedly, Jordan has great potential sources of renewable energy, particularly solar and wind energy. Jordan is located within the Sunbelt where the intensity of direct solar radiation is 5-7 kWh/m² and wind speed in specific areas ranges between 7-9 m/s; the data is promising to generate electricity in Jordan. Based on the previously mentioned figures, the overall comprehensive strategy for energy sector aims at diversification of energy sources and reduction of reliance on energy imports and contributes with 10% of an overall energy mix by 2020.

Most prominent achievements in 2016



1. Solar Energy

- All 12 photovoltaic projects-direct offers and commercial operation to generate electricity with a capacity of 200 MW have been achieved in 2016.
- The commercial operation of Philadelphia Solar Power Company IPP PV project-direct proposals Round I has been achieved in 22/10/2015 with a capacity of 10 MW in Mafrq. The “first-of-its-kind” project connected to this distribution network
- Complete PV Solar Power plant to generate electricity with a capacity of 5 MW in Azraq. The project is financed by a Spanish-Jordan Debt Swap agreement with the Spanish Government implemented on EPC contract basis and operated by April 2015.
- Thirty-four photovoltaic tenders were submitted in Round II- direct proposals to develop 4 PV projects with a total capacity of 200 MW (50 MW each) in the developmental zones of Al-Mafrq region and Safawi/Azraq. The Ministry has signed 4 MOUs achieving financial closures and expecting operation in 2017-2018. The agreed rates declined to unprecedented low levels (ranging 43-55 fils/kWh).
- Sign a contract and carry out an implementation of a photovoltaic project on 20/12/2015 with a capacity of 103 MW in Qweirah/Aqaba with the awarded consortium TSK/ Enviromena under an Engineering, Procurement and Construction contract EPC and funded by UAE/ Abu Dhabi Fund for Development and expected to be operated in 2017.
- Under the German Government Grants, the German Development Bank (KfW) to finance a solar plant to produce electricity for the Za'tri camp and refugee host communities at a value of 15 million euros. The solar project tender has been awarded to Belectric Gulf Ltd on 1/3/2016 under an Engineering, Procurement and Construction contract EPC with a capacity of 8-10 MW in Za'tri camp. The contract was signed on 8/9/2016. The company has carried out project implementation and likely to be linked and operated during 2017.
- Masdar, a clean energy developer based in Abu Dhabi, UAE, signed a Power Purchasing Agreement to build a solar power plant on 22/10/2016 for a capacity of 200 MW in Muwaqqar. The project is currently achieving financial close and due for completion by 2018.

2. Wind Energy

- The private sector represented by Jordan Wind Project Company JWPC has started the commercial operation of TafilaWind Farm, the first large-scale renewable energy IPP on 16/9/2015 with 117 MW of capacity on EPC contract basis.
- The first phase of wind project operation to generate electricity and feed the grid with a capacity of 66 MW on EPC contract basis in Ma'an on 22/9/2016. The project is funded by Kuwait Fund for Arab Economic Development and the work is in progress to implement the second phase to expand the project to 14 MW of



capacity which is expected by mid-2017.

- Wind Projects- Direct Proposals-Round I with a total capacity of 330 MW in southern Jordan. Purchase power agreements were signed with all five companies. All projects are currently achieving the financial close and expecting operation in 2017- 2018.
- The Korean KEPCO direct offer in al-Fjej/Shoubak with a capacity of 90 MW. The purchase power agreement was signed on 13/12/2015 and it is expected to be operated by end of 2018.

3. Round III- Direct Proposals

The Ministry of Energy and Mineral Resources MEMR announced an expression of interest on 13/12/2016 from qualified developers with in-depth experience in IPP/ BOO schemes interested in investment in renewable energy projects for power generation on build, own and operate BOO basis. MEMR wishes to develop 200 MW of four solar PV Projects with a project size of 50 MW each and wishes to develop 100 MW of two wind Projects with a project size of 50 MW each. All requests for submission of expression of interest shall be submitted by 15/12/2017.

4. Small-Scale Renewable Energy Schemes

The number of small-scale renewable energy schemes installation and connection to the grid for residentials, universities, commercial and industrial enterprises, government institutions, schools, mosques, churches, telecommunication companies, banks, CBOs, hospitals, farms, etc. sectors has reached a total of 80 MW and a total of 17 MW of solar systems using instructions to the installation and regulations related to Photo Voltaic PV Systems for the power purchase agreement of electricity generated from renewable energy (net metering and wheeling systems) respectively.

On the other hand, MEMR has succeeded to manage nine EU funded projects within REED program. However, the projects has targeted wide range of CBOs aimed at spreading green energy use, CO2 emissions mitigation beside creating direct and indirect job opportunities to promote energy security and reduce energy imports expected to be completed by mid-2017.

Asummary of the status of these Projects in 2016

- Princess Alia Foundation aims at increasing the use of renewable energy in education premises and raises the standard of living in the pockets of poverty in Middle Jordan Valley. It ensures developing and connecting renewable energy schemes in 18 schools completely to the existing electrical grid and adopts energy efficiency systems.
- Conduct a feasible study to install renewable energy schemes in 20 schools and solar heaters systems in refugee hosting communities supported by the Norwegian Refugee Council. The project replication allows areas like Irbid and Jerash access to revenue potential from renewable energy schemes. The project has been fully implemented and many workshops have been held to raise awareness of energy management and energy efficiency mechanisms in the targeted schools.



- Settle renewable energy and energy efficiency schemes in buildings implemented by the Higher Council for Science and Technology HCST to adopt the policy and procedures of energy efficiency and renewable energy. The project consists of four main activities; all under implementation with around 85% of achievement.
- Use PV applications in Al Basheer and three government hospitals. The project to be implemented by Millennium Energy Industries Company MEI. Preliminary studies of three targeted hospitals were delivered in addition to Al Basheer Hospital. The company contracted with the National Energy Research Center NERC (a specialized technical authority) to review the project outputs. A tender for solar water heaters has been also submitted. All project activities reached around 45% of implementation.
- Future Pioneers for Empowering Communities to implement installation of renewable energy and efficient schemes for houses of worships i.e., mosques and churches and provide training for renewable energy schemes users. The project is fully completed and delivered.
- Sahara Forest Project kicked off the building process for the launch station to develop and sustain green communities by establishing clean energy station and provide energy and water solutions for outdoor cultivation and revegetation in Southern Jordan. For the SFP close site to the airport in Aqaba, a representative from EU was assigned to study the impact of the project on the aviation control system. The Prime Minister was provided with the outcomes of the study in June and the project equipment was shipped after being approved and the project has reached around 35% of implementation.
- Convert the Islamic Hospital into a green building using renewable energy schemes to generate electricity from solar PV system and energy wheeling regulations. The project is implemented by the Islamic Charity Center Society and mostly achieved around 45%.
- Establish a factory and a laboratory in German Jordanian University GJU to produce biogas out of agricultural and food wastes in CBOs. The project is located in German Jordanian University farm due to environmental and logistical site convenience in a 25-year agreement. The lab was opened in December 2016 and the actual project completion has reached around 90%.
- Settle initiatives of renewable energy and energy efficiency schemes in government buildings by conducting feasible studies in cooperation with the University Cooperation/Italy at six sites affiliated with the National Center for Agricultural Research. All studies have been carried out.

The Ministry also striven to encourage citizens, the public sector, the private sector and other state agencies to support renewable energy projects and energy saving equipment by studying the applications submitted to the ministry with regard to exemption from custom duties and eliminate the GST zero-rate to renewable energy and energy efficiency input by the committee on tax exemptions in accordance with the Article (3/A) of Regulation no. 13 of 2015.



The Energy and Environment

- Issue amended instructions of regulating and licensing activities related to industrial fuel from waste with the participation of the concerned institutions in the Official Gazette on 1/8/2016.
- Draft amendment regulations for licensing biofuel activities with the participation of the relevant institutions.
- The Ministry co-partnered the Ministry of Environment MOE membership in the National Committee for the Inventory of mercury and its compounds in the Kingdom.
- Ministry of Energy and Mineral Resources MEMR and Ministry of Environment MOE membership in the National Committee for the management of mineral oil and waste on recovery and collection of waste oil in the Kingdom.
- The Ministry co-partnered World Agriculture Organization, the Ministry of Planning and International Cooperation and relevant institutions in the steering committee of the solid waste transfer project in Za'tri camp, enhance the economic growth potential in Mafrq by developing private sector projects, and improve livelihoods, environmental sustainability and green jobs.
- The Ministry and Jordan Standards and Metrology Organization JSMO participated to set the technical base for biodiesel through a technical committee concerned with studying licensing applications for biodiesel plants.
- The Ministry co-partnered Greater Amman Municipality in a technical committee to study technical and financial proposal of generating electricity out of solid wastes using latest technologies of direct burning in Al-Ghabawi landfill. The Chinese CNTY has been awarded the project at a cost of \$ 200 Million.
- The Ministry has participated in the bidding committee and the technical committee responsible for rehabilitation Al Akeder landfill to generate electricity out of solid wastes. The rehabilitation was launched at 30 MW of capacity and at an estimated cost of \$150 Million.
- The Ministry co-partnered NEPCO and Japanese Agency for International Cooperation in the technical committee responsible for the assessment of the environment impact of power generation projects to prepare a comprehensive plan for the electricity sector.
- The Ministry as a member in the technical committee drafted a report on the second environment condition and has an overall supervision on the energy chapter.
- The Ministry has started procedures towards licensing advanced factories to produce industrial biodiesel out of waste under supervision of licensing committees.
- The Ministry as a member in the environment assessment committee has submitted many project studies for projects in general and for power generation projects in particular to the Ministry of Environment.



Jordan Renewable Energy and Energy Efficiency Fund JREEEF

The Jordan Renewable Energy and Energy Efficiency Fund -JREEEF in accordance with a comprehensive plan has implemented set of projects and programmes targeting various sectors in all governorates to accomplish objectives of the National Energy Strategy and the National Energy Efficiency Plan through implementing various programmes and finances in partnership with international organizations, commercial banks, sector foundations and CBOs.

JREEEF Programmes and Projects for 2016

- Supply and install energy-saving lamps in government buildings substituted by a project of replacing incandescent bulbs and fluorescent bulbs with LED light bulbs in households.
- Towards CBOs to rationalize energy consumption by installing solar heating systems on rooftops in cooperation with the Jordan River Foundation. The full value of the grant has been implemented in 2015 and the programme is still being recycled for new beneficiaries.
- Install 20,000 solar heaters for the year 2017 at households in cooperation with CBOs, the Association of Retired Servicemen and Veterans, commercial banks and electricity distribution companies.
- Promote programmes and projects for JREEEF, The project consists of two rounds. Round one has been completed and currently tender documents to be prepared for Round two.
- Support creativity by establishing appropriate criteria used to measure RE & EE quality in submitting researches, studies and application forms.
- Install solar energy schemes on the roofs of houses /European grant- tender evaluation stage.
- Develop training and capacity building program in renewable energy. A training framework has been developed-pending donor approval.
- Energy Conservation Program in cooperation with the National Center for Research and Development NCRD. Energy audit studies have been prepared and there is an agreed method to for measuring and verifying energy savings for the hotels program.
- Energy efficiency fund to process energy auditing studies outcomes in the Ministry.
- Process energy auditing studies for 11 government premises and to extend it for a further six months by March 2017.
- Run on solar energy for mosques throughout the Kingdom. The tender has been submitted by Ministry of Awqaf and Islamic Affairs to start implementation in 100 mosques.
- Using solar heaters in cooperation with the National Center for Research and Development. The draft agreement with the Center has been submitted and pending approval from the Prime Ministry.
- Run on solar energy in the Prime Ministry. The project has finally been completed expecting project close-out and handover.



- Support tourism program for three star hotels and below in Petra and Aqaba regions. Energy audit studies were conducted, terms of reference were agreed, implemented companies were approved, and all necessary agreements were signed with the aforementioned hotels.
- Install central heating in 50 public schools located in Arjan/Ajloun to be implemented in cooperation with the Canadian grant and coordination with the Princess Alia Foundation for implementation in Jerash, the European Bank for Reconstruction and Development-EBRD to conduct a technical and economic study in 50 schools. The National Energy Research Center to be the executive arm of the school heating program.
- Implement the National Energy Efficiency Action Plan. The draft has been prepared, studied and circulated to all the relevant institutions for observations awaiting final Prime Ministry approval.

Electricity

Achievements in 2016

- The rehabilitation of Hussein Thermal Power Station project agreements were signed on 28/12/2016 and reached financial closure on 29/12/2016 with a capacity of 485 MW and a total cost \$ 470 million expected to be commercially operated in mid-2018.
- Based on the executive agreements signed between the Ministry of Energy and the companies developing the Independent Power Producer Projects IPP1, IPP2, IPP3, IPP4, the Ministry has studied the requests of companies regarding customs exemptions for equipment, supplies, operation, and maintenance. Around 550 letters necessary for the Investment Promotion Commission, Ministry of Labor and Ministry of Interior for purposes of renewal of contracts and residencies for foreign workers.
- Draft, review and discuss the Arab States' comments on the memorandum of understanding to establish a joint Arab electricity market aimed at achieving a long-term vision to create an integrated and competitive electricity market engaging all Arab countries through electricity interconnection and electricity trade within the regional linkage groups, represented by the Arab connection project (Eight electrical connection project, the Gulf Cooperation Council GCC project and The Maghreb Countries Interconnection Project) through the meetings of the Electricity Experts of the Arab States. The Council of the League of Arab States has approved the Memorandum of Understanding on 8/9/2016 at the ministerial level.
- A memorandum of understanding was signed between Jordan represented by NEPCO and the Gulf Cooperation Council GCC on 19/5/2016 to enable both parties to start technical and economic feasibility studies for Jordan-Saudi electrical interconnection Saudi Arabia project. Several meetings between Jordan and the Gulf Cooperation Council GCC were held during 3-4/8/2016 to discuss the possibility of the electrical connection between Jordan and the GCC countries.
- Participate in expert committees in the fields of electricity, renewable energy, natural gas of the Union for the Mediterranean. The final drafts for work programs



of all platforms (electricity, gas and renewable energy) were approved as well as the Ministerial Declaration of energy for the member states of the Union for the Mediterranean.

- Assign Samra Electric Power Company SEPCO to convert the seventh gas turbine with 145 MW of capacity to a combined cycle by adding a gas turbine with a capacity of 70 MW which aims to improve the seventh unit efficiency and reduce consumed fuel. The Chinese SEPCO was awarded the project on 25/5/2016 at a total cost of around JD 75 million. The project to be operated within (24) months by 2017.
- To review the current electricity tariff, Energy & Minerals Regulatory Commission EMRC drafted the terms of reference to assign a consulting company to discuss the restructuring of the electricity tariff. The initial assignment was given to Mercado Consultants, Inc. pending non-objection by the funding sponsor.
- The Jericho Electricity Supply Agreement was amended on 30/4/2016. The tariff of Jerusalem District Electricity Co. Ltd. Private Company JDECO for supplying electricity to Jericho will be linked to the tariff of the Electricity Distribution Company EDCO in the Hashemite Kingdom of Jordan as issued by the Energy and Minerals Regulatory Commission EMRC with 5% profit margin added to the daily, night and maximum demand tariff.
- A memorandum of understanding was signed on 14/6/2016 between the Ministry of Energy and the Modern Cement & Mining Company Limited MCMC to construct a 30 MW fossil fuel power station to supply the company's cement plant with the required electricity.
- The Ministry has provided Jordan Nuclear Power Company JNPC and Tractebel-a global engineering consultancy company both with data requested to study the possibility of connecting the nuclear power plant with the national grid and study Jordanian electricity market.
- An agreement was signed between NEPCO and the Ministry of Water and Irrigation to discuss NEPCO's covering electricity needs of the Red Sea-Dead Sea Water Conveyance Project (Red-Dead).

Natural Gas

The Ministry of Energy and Mineral Resources seeks to achieve the strategic objective of increasing the contribution of natural gas to the total energy mix, adopting and implementing initiatives and programs below during 2016:

First: Development of natural gas resources

- To attract strategic partner, the Ministry and the National Petroleum Company NPC to develop and enhance the company's facilities and expansion plans in Risha concession area. The National Petroleum Company NPC has signed a production sharing agreement for Risha concession and facilities (transfer of shares, operation and implementation). The IPG Oil and Gas Ltd. Company was granted concession rights to explore for gas and oil in east Safawai area on 29/3/2017 under Council of Ministers decision No. 14645 on 23/3/2016.



- Risha Gas field local production of natural gas has amounted to 4,112 Mcf of natural gas and around 11.2 Mcf/d by 2016.

Second: Expansion of natural gas use in power plants and Industry:

- The Ministry of Energy and Mineral Resources in cooperation with the National Electricity Company to secure LNG need for power plants in two agreements signed between NEPCO and Shell International to purchase LNG for five years 2015-2020 and two years 2016-2017 to provide NEPCO with 150 Mcf/d of LNG Moreover to Cover Nepco's needs of LNG, 3 Cargoes were Purchased via spot market in 2016 .
- LNG total shipments has amounted to 48 shipments in Sheikh Sabah Al Ahmad Terminal for 2016; by which 40 shipments were consumed in power plants and 8 shipments were exported to Egypt under trade surplus agreement signed on 5/8/2015.
- LNG total shipments in Sheikh Sabah Al Ahmad Terminal have amounted to 6.8 million cubic meters equals 4.1 billion cubic meters gas situation.
- LNG total quantities consumed by power plants have amounted to 122,676 Mcf With Average daily quantities 335 Mcf and hit 87% of power generation in 2016.
- Due to FSRU/LNG surplus estimated at 70-200 million cubic feet per day, A Floating Storage Regasification Unit FSRU agreement was signed between the National Electricity Company NEPCO and the Egyptian Natural Gas Holding Company EGAS on 6/8/2015 to benefit from the excess capacity of the gasification ship and provide the Egyptian side of the surplus storage capacity of FSRU provided that priority is given to the Jordanian side to meet the full LNG needs of power plants and industries.
- LNG total quantities exported to Egypt have amounted to 25,445 million cubic feet with a daily average of 70 million cubic feet for 2016.

Supply LNG Industries

- Under the resolution No. 12023 on 14/10/2015; the Council of Ministers has tasked a steering committee presided by the Ministry of Energy and Mineral Resources to study the contractual, technical and legal aspects of supplying Industries with LNG.
- The steering committee comprised a technical committee to study the regulatory, contractual and technical requirements for LNG supply on 29/10/2015. The Steering Committee studied and submitted the report and recommendations to the Prime Minister for approval.
- For the purpose of the above mentioned recommendations and in light of the approval of the Council of Ministers decision No. 14588 on 20/3/2016, it was agreed to start supplying industries of infrastructure already converted to natural gas whenever ready.
- The Steering Committee comprised a technical committee on 10/4/2016 to establish clear and transparent bases to determine LNG supplying priorities, study applications and reports received from LNG interested industries, technical



and operational requirements and specifications needed for gas pipelines and necessary infrastructure.

- The Steering Committee has adopted LNG supply priorities and assigned the Jordanian Egyptian FAJR for Natural Gas Transmission & Supply Company to connect LNG interested industries on 23/6/2016.
- Under the guidance of the Ministry of Energy, the Jordanian Egyptian FAJR Company cooperated with Egypt Gas Company and took the necessary measures to study the possibility of supplying major industries with natural gas to the stage of negotiating the agreements with Nuqul Group factories, United Iron and Steel Manufacturing Co PLC [Manaseer Steel] and Jordan Phosphate Mines Co JPMC.
- A Master Gas Sales and Purchase Agreement was signed between NEPCO and FAJR Companies on 7/8/2016. This agreement regulates sales and purchase of natural gas through Sheikh Sabah Al Ahmad Terminal and it will be the main umbrella for natural gas sales agreements to be signed between FAJR and the LNG interested industries.
- Pursuant to decision No. 277 on 19/10/2016, The Council of Ministers has approved supplying the United Iron and Steel Manufacturing Co PLC [Manaseer Steel] and Al-Snobar Hygienic Paper Mill Co. Ltd. (Nuqul Group) with natural gas.
- The Petroleum Products Pricing Committee has been assigned by the Council of Ministers decision No. 292 on 23/10/2016 to decide the monthly prices of natural gas which will be sold by the National Electricity Company to FAJR Company for industrial supply.
- A regulatory protocol No. 2/2016 was signed by the Ministry of Energy and Mineral Resources and the Jordanian-Egyptian FAJR Company to set a clear and transparent mechanism of pricing natural gas sold to industries on 27/10/2016 by Council of Ministers decision No. 351 on 26/10/2016.
- Issue the final draft of LNG Sale and Purchase Agreement and an agreement of establishing a new LNG supply point to be signed between FAJR and Industries with the approval of the Ministry of Energy on 26/12/2016.
- To provide distant small industries with LNG, a technical committee was set on 3/2/2016 to establish the stipulations and requirements to get a license and distribute LNG and CNG tankers to interested companies.
- Pursuant to the Council of Ministries decision approval No. 14044 on 17/2/2016 with regard to licensing contracts for purchasing natural gas from Noble Energy Company. Licence contracts shall be granted for both the Arab Potash Company and Jordan Bromine Company to import and purchase natural gas on BOO basis to transport natural gas to the licensed factories.

Third: Provide dependable sources of natural gas

- Sign LNG sale and purchase agreement in September 2016 between NEPCO and Noble Energy to supply the Kingdom with natural gas from the supply point on the Jordanian border near the Sheikh Hussein Bridge to the point of connection with LNG pipe in Rehab.



- Sign MoU between the Government of the Hashemite Kingdom of Jordan and the Government of the People's Democratic Republic of Algeria on 16/5/2016 for energy cooperation. It studied the possibility of importing LNG from Algeria and benefiting from the expertise in LNG extension and distribution networks.
- Joint bilateral cooperation between Jordan and Tunisia was discussed in Joint Jordanian-Tunisian higher committee. A protocol of technical cooperation in electricity, LNG and renewable energy was signed between the Hashemite Kingdom of Jordan and the Government of the Republic of Tunisia on 7/12/2015.
- Ongoing discussion to develop bilateral cooperation between Jordan and Egypt in energy, renewable energy, LNG and electricity in Joint Jordanian-Egyptian higher committee to activate the MoU signed between Jordan, Egypt and Iraq on 15/11/2015 in LNG and crude oil.
- Iraq and Jordan have signed and agreed in principle to provide Jordan with 100 Mcf/d of natural gas on 27/12/2012 and export Iraqi crude oil via Jordanian territories.
- Discuss areas of cooperation in the energy sector with countries like Qatar, Cyprus, and Russia.

Bio Energy

Jordan Biogas Company Ltd. continues processing the organic waste in Rusaifa Landfill. The generated electricity quantity in 2016 has amounted to 6.5 GWh. The mitigated volume of biogas has amounted to 5 million cubic meters.

Peaceful Uses of Nuclear Energy

Jordan's interest of nuclear energy stemmed from the dire need to face all challenges represented by the scarcity of domestic energy and water sources. In other words, to provide domestic long-lasting sources of energy, the National Strategy of Energy for 2007 has strengthened the development role of energy domestics and diversification by introducing nuclear energy as an alternative to electricity generation. Accordingly, Jordan Atomic Energy Commission was created in 2008 to achieve two major goals:

- Transfer, develop and sustain the peaceful uses of nuclear energy and radiation technology to the Kingdom.
- Hold investment projects to boost national economy in radiation technology and nuclear energy and utilize it in electricity generation, water desalination as well as other nuclear practices.

Accordingly, the commission has developed a strategy for nuclear energy represented by the Jordanian nuclear program includes exploitation and investment of nuclear natural resources especially Uranium, establishing and operating Jordan nuclear power plant, empowering qualified domestic human resources, and supporting nuclear sciences and applications infrastructure to better serve science, educational research and community. Accordingly, Jordan Atomic Energy Commission has continued during the year 2016 all activities designed to achieve the objectives designated.



Major achievements of the Jordan Atomic Energy Commission:

First- Jordan Nuclear Power Plant

Based on detailed studies covering all possible areas, the Nuclear Power Plant Commission has finally selected Jordan Nuclear Power Plant site in Amra. JAEC announced that Rosatom's reactor export subsidiary Atomstroyexport (ASE) would be the supplier of two nuclear units on a build, own and operate (BOO) basis including third generation (+) technology of Russian reactors with a capacity of 1000 MW each at best international standards of safety, security and non-proliferation.

Jordan's first nuclear reactor is expected to start operating in 2024 succeeded by the second reactor two years after. Generally, Russian reactors were originally licensed, built and operated using this type of technology.

The government has approved establishing Jordan Nuclear Power Plant Company to complete site work, possibility of reliability to grid with NEPCO, need for water, and all technical needs and financial studies required. It is worth mentioning that the International Advisory Group of Jordan's nuclear program which involved international nuclear experts and specialists in nuclear security and nuclear regulation had the first meeting in Amman from 2-4/2/2016 to outline progress achieved so far, submit a report and seek an independent consultation in the Jordanian nuclear programme. During stay in Jordan, the International Advisory Group shall review the programme achievements of three projects: Jordan Nuclear Power Plant, Jordan Uranium Mining, Human Resources Development counting Jordan Research Training Reactor (JRTR), the regulatory and supervisory body of the Jordanian nuclear program, subcritical assembly and Nuclear Engineering Program as well as visiting the sites of the Jordanian nuclear Research Training Reactor, the Nuclear Engineering Laboratory, and Subcritical Nuclear Assembly at the Department of Nuclear Engineering at Jordan University of Science and Technology campus. The International Advisory Group submitted a comprehensive detailed report underscores recommendations, programme achievements with a high level of efficiency and transparency, the regulatory body of nuclear energy in Jordan, the nuclear engineering program at Jordan University of Science and Technology. The report is significant in light of the progress of the Jordanian nuclear program projects and the public opinion to answer all questions and dispel concerns of Jordanian community and ensure the operation of the program in accordance with the standards and foundations of the International Atomic Energy Agency.

To guarantee the fulfillment of the workflow, the Commission works on preparing a bank feasible study with the investor and the operator to ensure financing, complete signing agreements and program implementation. In parallel, the Commission is working on introducing Small modular reactors (SMRs) at reduced costs-in addition to the large nuclear plant project intended to be used in the city.

In this context, the Commission exerts deliberate efforts to work with the International Atomic Energy Agency IAEA and the Arab Atomic Energy Agency AAEA on the implementation of technical and national projects in support of several national and regional projects in the nuclear and radiological applications and prepare to sign agreements and MOUs in nuclear cooperation between Jordan government and friendly developed countries.



Second- Empower Jordan HR Core Competencies

The commission has continued in 2016 carrying on all appropriate plans to complete Jordan Reactor for Training and Research JRTR, the cornerstone to Jordan Center for Nuclear Research, in University of Science and Technology. The achievements in 2016 involved the Korean consortium have built and delivered the project in principle to the Jordanian side. It also helped in verification of the integrity of the test results and conformity with the preset acceptance criteria. During 2016, a number of hot commissioning tests of the Jordan Research and Training Reactor JRTR were completed. The follow-up involved the transfer of nuclear fuel transfer to the site of the reactor in cooperation with the concerned authorities. The Directorate of Nuclear Safety and Security in the Commission co-partnering a specialized committee prepared the plan for the physical protection of nuclear fuel during transportation. The Energy & Minerals Regulatory Commission EMRC which contributed in transportation process had officially approved the plan. The process involved loading nuclear fuel into the reactor to access the critical case on 25/4/2016. It is indeed a historic event of Jordan having the first subcritical reactor.

In 2016, the Commission followed up the licensing requirements, establish an emergency center, prepare the radiation prevention plan, equip laboratories of scientific research and neutron activation, prepare a business plan to market radioactive isotopes produced. In April 2016, the Jordanian Atomic Energy Agency signed a memorandum of understanding with the Royal Medical Services in the area of radioisotope production and utilization, benefiting from the accumulated experience and capacity built over a long period of time at the RMS. The achievements of this significant work ended with opening the Jordan Research and Training Reactor JRTR under Royal patronage at the beginning of December 2016.

The Commission has continued enhancing the scientific and specialized infrastructure for human resources required to attain the Jordanian nuclear program by providing Jordanian students with international scholarships to study Masters and PHd degrees in the disciplines of nuclear sciences and engineering over grants in nuclear training provided by developed countries in nuclear energy, in particular those who have signed nuclear cooperation agreements like Russia, China, France, South Korea, China and Japan. The envoys for Masters and PHd programs equaled 145 students.

The Commission has also allocated scholarships programmes for the central Badia undergraduates to study nuclear engineering at Jordan University of Science and Technology.

Third - Uranium Utilization

The achievements of the Nuclear Fuel Cycle Royal Commission has implicated the continuance of the Jordanian Uranium Mining Company JUMCO the organized and systematic exploratory work in the midst of Jordan undertaken by Jordanian specialized team under the supervision of seven international experts and specialists to perform the following operations in 2016:



Consequent to the first stage in 2014, Uranium resources estimates of U_3O_8 in the explored region have reached 36 thousand tons on exploratory results according to a global JORC Code-2012 Edition that confirms the presence of uranium in the center of Jordan in commercial quantities adopted by investment companies. In 2016, a final report was issued to estimate the uranium reserves by 40,000 tons according to the Joint Committee rules.

A systematic exploratory work in the midst of Jordan to extract uranium ore has been improved. The Jordanian Uranium Mining Company team has designed the industrial process for the extraction of uranium using in-situ leach, a new technological development. The study was tested at semi pilot level and one kilogram of yellow cake was produced after processing 6 tons of crude in 2016.

Another team of the Commission's laboratories worked on constructing a testing unit for summer 2016 to produce yellow cake from the raw materials in the midst of Jordan 90% high purity using domestic resources to reduce the economic cost. A practical preparation for technical and field development is set to use 20,000 tons of uranium ore to extract around 2 tons of yellow cake in summer 2017.

Fourth- Nuclear Sciences and Applications

The Nuclear Science Applications Commission has carried on the development of scientific laboratories and various nuclear applications in 2016 which aimed at the development and transfer of peaceful uses of nuclear energy and radiation technology in Jordan through developing skills and empowering human resources to enhance the infrastructure for nuclear science and technology by holding seminars, specialized training, scientific research visits inside and outside Jordan, laboratory testing and analytical services for production and services sectors particularly those provided by the secondary calibration laboratory, laboratory to measure the exposure of personnel to radiation, and the Mega Gamma-1 Irradiator center to radiate various samples and sterilization of medical devices and research purposes. Meanwhile, the Synchrotron and Accelerators directorate carried on implementation of the national scientific activities to identify work development and mechanisms of support provided to Synchrotron centers, to empower qualified staff and support scientific research. The Nuclear Applications directorate likewise follows up all projects and scientific research activities in universities, research centers and production and services sectors in Jordan financed by the International Atomic Energy Agency IAEA and the Arab Atomic Energy Agency AAEA.

Jordan Atomic Energy Commission has paid all attention to maintain life and environment. In implementing all Jordan nuclear projects, JAEC has endorsed full transparency, full commitment to public safety and nuclear security requirements based on standards approved by the IAEA and complying with the laws and regulations governing the environment, radiation protection, and nuclear safety and security in Jordan.

Co-partnering Center for Strategic Studies at Jordan University, the Jordan Atomic Energy Commission JAEC launched "Knowledge and Perception of the Jordanian nuclear energy" on the social acceptance of the Jordanian nuclear program and aimed at measuring knowledge on the Jordanian nuclear program and energy problems in



general and in Jordan in particular. It also considered fears and concerns of Jordanian citizens about the use of peaceful nuclear energy in Jordan. In general, the study aimed to explore to what extent peaceful nuclear energy is aware of and trends towards peaceful uses in Jordan, public knowledge and awareness of the peaceful uses of nuclear energy. The study showed 72% of Jordanians and 71% of leaders agree to build the Jordanian nuclear program. The result disclosed high levels of awareness and advanced culture for Jordanians in uses of nuclear energy to generate electricity.

Geology and Mining

The mining sector is one of the vital sectors that play an active role in driving growth and development in the national economy. Despite the instability in contribution all over different periods, geology still possess a great value and represents one of the most important pillars of the national economy.

The mining sector is mainly based on the exploitation of local raw materials and comprises of the two main mining industries:

- Mining Extractive Industries Phosphates, potash, carbonate and quarrying products, etc.
- Mining Transformative Industries

A. Chemical Industries

Fertilizer, chemical acids, quick and hydrated lime.

B. Construction Industries

Cement, white cement, ceramics and building materials.

The Ministry traded mineral resources via conferences and specified local and international workshops inside and outside Jordan.

Major projects carried out by the MEMR in 2016:

1. Geological Mapping

The National Mapping Project aims at producing geological maps at different scales (1:50,000) and (1:100,000) for entire Jordan; in addition to the petrographic studies, the Geological Museum and the Training.

The following table shows the current status of geological maps:

No.	Maps/ Bulletins	Scale	Current Situation
1	Ain Jedi & As-Safi Map	1:50,000	Ready for publishing
2	Mishah Hudruj Map	1:100,000	Field work in progress
3	Wadi Hudruj & Wadi Ed Dhbei'ani Map	1:100,000	Field work in progress
4	Wadi El-Fkok Map	1:100,000	Field work in progress
5	Ras An Naqab Map	1:50,000	Field work in progress
6	Wadi Al Ghamar Map	1:50,000	Setting the main frame and correlated to surrounding maps
7	Wadi Maghar Bulletin	-	Under Printing
8	Al Inab Bulletin	-	Under Preparation



2. Petrographic Studies

Study components of rocks and minerals for the Ministry, public and private sectors projects for price.

In 2016, 17 rock samples, 26 microscopic samples were studied and 11 scientific reports were prepared.

3. Geological Museum

It highlights significant achievements and the nature of the works it carries out in mineral resources through museum visits for all interested sectors. The number of visits amounted to 1619 from public and private schools.

The Geological Museum participated in two exhibitions; the Earth Month organized at the Children's Museum in Al Hussein Public Parks which displayed significant activities of the Ministry of Energy and Mineral Resources and the Second Jordan International Energy Summit.

4. Prospecting Studies

The studies aims to add new prospect areas to increase the reserves, besides determining the horizontal and vertical extension of the ores, calculate quantities, and conduct the necessary tests to determine the quality of the oil shale, in order to provide accurate information for investors and prepare areas to be ready for investment.

Achievements in 2016 :

1. Oil shale Projects

A. North Jafr

- Drill 40 exploration boreholes with a total depth of 4993 m and a total cost of 370689 JD covered by the "Gulf Grant". It was found that the oil shale thickness for the area is more than 200 m.
- Collect 818 samples for analyses as follows; 28 samples for density and 790 samples for geochemical analysis (TOC, sulfur content, major oxides) etc.
- Obtain all density analysis results.
- Complete 90% of the F.A. results.
- Complete 25% of the XRD and XRF results.

B. Bayer

Drill 21 exploration boreholes with a total depth of 2528.75 m and a total cost of 221405 JD covered by the "Gulf Grant". It was found that the oil shale thickness for the area is more than 120 m.



2. Coquinal Limestone Prospecting Project

A. NE Qatrana

- Drill a total of 20 boreholes with a total depth of 349 m and collect 48 samples from 10 boreholes. The samples were described and sent for analyses (major oxides and whiteness).
- Complete 60% of the analysis results.

B. North Hisa

- Commence a reconnaissance field trip after collecting all necessary information about the area using remote sensing. Four expected prospecting localities are under consideration to ensure mining rights and licenses for any future investment opportunities.

Many technical reports and prospection studies were prepared in 2016:

- Complete a prospecting study of the pure limestone in Southwestern of Hisa Area.
- Complete 85% of an oil shale report in West Hisa Area.
- Complete 75% of an oil shale report in Adh Dhirwa Area.
- Complete 35% of an oil shale report in North Jafr Area.
- Complete 90% of a geology report in Dir Abi Sa'id Area.

5. Geochemistry

To carry out the surveys and investigation works for mineral exploration using different geochemical methods, the geochemistry of heavy minerals, stream sediments and rocks in the south of the Kingdom, and follow up the results of laboratory analysis of the various geochemical samples and evaluation. The Following is a summary of the work completed during 2016:

1. General Geochemical Survey Project

- Field Achievements

Complete the geochemical survey for three areas; Jabal Harad, Ain Al Hashim, and Ma'in. 128 samples were collected from these areas; 50 samples of heavy minerals, 18 rock samples and 60 water samples.

- Laboratory works

Send 190 samples to the Ministry's laboratories for analysis, using XRD, ICP analysis devices. Collect 144 received samples; 42 samples received Jabal Al Harad analysed by XRD, ICP, 52 samples received from Ain Al Hashim analysed by AAs, ICP and 50 samples received from Ma'in and Aqaba analysed by ICP, XRF.

2- Geochemical studies for iron ores in Wdi Abu Al Asal-Dead Sea Area and Humrat Area – Balqa Area. 40 samples were collected for chemical analysis and a technical report was written about the study and a scientific paper was published in a world-Class journal entitled now discovery of Fe-Mn Mineralization along Abu Asal fault/dead sea area, central Jordan.



3- Geological and geochemical studies for the chalk deposits in Delagha -Ras El-Naqab. 30 samples were collected for chemical analysis by ICP, XRD, and XRF analysis devices. Some analyses results were completed and received while the rest of the analyses work in region to be completed in 2017.

A Geochemical Exploration for Minerals in Wadi Sabet Area South Jordan scientific report and a detailed study in the separation of heavy minerals from the phosphogypsum in Aqaba area were completed.

6. Geophysical Studies

The geophysical studies are conducted in several parts of Jordan to support other geological surveys in order to locate the anomalous areas, which help in mineral exploration projects and earth crust studies including geological structures and groundwater reservoirs and geotechnical studies.

The achievements in 2016 were as follows:

1. General Gravity Survey Project

The significance of the project lies in carrying out the integrated geophysical and geological studies and prospecting mineral resources, locating the groundwater reservoirs and geological structures.

Gravity survey continued during 2016, according to the project plan in the southern Jordan (Dubaydeb, Batn Al Ghul and Mudawwara). A total of 508 measuring gravity stations have been measured during the year, observing its coordinates. Necessary corrections have been made beside the calculation of free air, Bøuguer anomaly and gravity values at every point, and attaching all new measurements to the saved data base of general gravity survey of the Kingdom.

2. Geophysical Studies for the Exploration of Iron Ore in Ma'in Area

The study aims at conducting the prospecting and exploration works for the iron ores in central Jordan area using geophysical surveys in order to determine the ore quality and quantity economically. Previous aerial geophysical data have been evaluated for Ma'in area showing anomaly in the aeromagnetic readings associated with the presence of iron oxides. All geophysical data have been integrated using Time Domain Induced-Polarization (TDIP). A 2-D model is going to be prepared after to illustrate the distribution of the ore with depth.

3. Water Exploration in Syrian Refugee Zone

An experimental geophysical survey has been conducted in Al Aqeb area-north Jordan, in cooperation with the Ministry of Water and the German Mineral Resources Agency in the Federal Institute for Geosciences and Natural Resources BGR. It was planned for the actual survey to start in the second half of 2016, but the BGR -for special reasons- was satisfied by the collected data. A technical internal report was prepared for the result achieved by this study.



4. Geophysical Services

A Geophysical study has been conducted in Warda Cave in Burma Area – North Jordan in order to determine the underground spatial extension of the cave which helps in defining the area needed to be possessed for geological tourism purposes. Five geo-electrical sections have been done using Wenner–Schlumberger Technology. All analyzed results were interpreted and showed difference in electrical ground resistance measurements. The high resistance measurements indicated the underground spatial extension of the studies cave and a technical report was issued accordingly.

5. Archiving of Previous Geophysical Surveys and Office work

During 2016, many of the aero-electromagnetic maps were digitized and archived. Moreover, A technical report was issued known as “Determination of the Extension Area of Warda Cave, Jerash Area, Northern Jordan”.

7. Jordan Seismological Observatory

The seismic observatory records, around the clock, any seismic activities through a network of monitoring stations (short and long frequency). A network of stations that monitor strong movement installed at important infrastructures in Jordan, for the purpose of registration the ground acceleration necessary for the earthquake-resistant engineering designs as well as developing seismic data to update the Jordanian National Building Codes and prepare earthquake catalogue.

Achievements in 2016:

- Follow-up maintenance and calibration of regular seismic stations and strong traffic stations according to monthly maintenance programs previously prepared to replace of broken parts and maintain the sustainability of monitoring process optimally.
- In 2016, Jordan Seismological Observatory JSO recorded 510 earthquake events as follows: 62 local earthquakes mostly in Jordan Rift Area (the strongest event happened in the Gulf of Aqaba on 16/5/2016, with a magnitude of 5.1), 116 earthquake within the Eastern Mediterranean regions, and 332 distant seismic.
- A Seismic station was constructed to the south of Aqaba (Titen Seismic Station to replace Al Durra Station).
- Working on the Early Warning System on a regional scale; two meetings were held in Rome on 24-29/1/2016 and in Dead Sea on 4-5/4/2016 to decide the needs of the system and training efficiencies.

8. Survey

It provides survey services for all the projects of the MEMR.

The achievements in 2016:

- Observe 81 survey points for the Gravity Survey Project in Althleethwat / Batn Al Ghul.
- Achieve the private survey tasks of the Gas pipe project, participate with the acquisition committees, and follow up all the tasks related with the project and governmental authorities.



- Work on the renewable and alternative energy projects (Tafila, Aqaba, Quwera, Madaba) - Acquisition and allocation.
- Inspect the “Tab Line” for collecting tools purposes.
- Inspect the gas line in Al Hussein Thermal Station-Zarqa and As Samra Electricity Power Plant.
- Inspect 35 permanent survey points in various areas.
- Calculate the heights and coordinates of the observed points to provide any concerned parties.

9. National Cooperation

Numerous specialized technical studies were submitted all over the Kingdom through scientific cooperation between the Ministry and national institutions:

- Follow up the extension of the Geological Maps Printing Agreement with the Royal Geographic Center.
- Cohort the Atomic Energy Commission to study and appraise the location of the proposed nuclear plant and prepare a work plan to study the rare earth elements in Dybaydeb area.
- Cohort the Jordanian courts by offering the technical advice in many hydrological and geological cases in Karak (Ain Al Lajjun case)
- Cohort Petra Development and Tourism Region Authority to report three witnessed diesel leaks.
- Copartner the Ministry of Water and Irrigation, within the framework of Groundwater Management Project, in order to define the groundwater basins in the Syrian refugee’s areas.
- Cohort the Ministry of Tourism and Antiquities to decide the area above Warda Cave (North Jordan) to make it a prominent geologic site for geotourism.
- Cohort the Department of Land and Survey.
- Cohort the Energy and Minerals Regulatory Commission by:
 - Investigating the landslide in Kufranja Quarry.
 - Field visits to Wadi Araba to insight the employees of the commission about the mineral deposits in the area.
 - Organizing a training course for one month about Minerals in Jordan for the commission employees
- Cohort the Jordan Petroleum Refinery to import the oil from Hamza Oil Field.
- Cohort the University of Al Hussein and Tafila Technical University to Handing over the drilling rigs.
- Cohort the University of Mu’tah to set an MOU for scientific cooperation.
- Cohort the Jordan Integrated Company for Mining (Manaseer) in the field of copper ore exploration to provide the company with previous studies.



10. International Cooperation

The Ministry cooperated with many international institutions in 2016:

- Cohort German Geophysical Research Center GFZ conducting Dead Sea Research Project by studying the sinkholes and seismic risk for Madaba and Karak cities likewise carrying out the geophysical surveys and aerial photography. The GFZ funded the construction of a second multi-function monitoring station granted 80000 Euro.
- Cohort Freiburg University conducting detailed studies for the Ordovician rock. Many samples were collected for paleontological and iconological studies as well as age determination.
- Cohort the German Mineral Resources Agency in the Federal Institute for Geosciences and Natural Resources BGR in Water Resources Management Project to define the groundwater basins in the Syrian refugees zones.
- Cohort Saudi Geological Survey in common Geochemical Survey Project in the border areas (from Red Sea-East to Mudawwara-West) with a total length of 96 km. The results of the chemical analysis were received from the Saudi Labs in December and the final scientific report about the project is in progress.
- Cohort the Comprehensive Nuclear-Test-Ban Treaty Organization CTBTO in the field of training.
- Cohort European-Mediterranean Seismological Center-Paris EMSC and the International Seismological Center-London in training and research.
- Cohort Japanese group in to decide active tectonics and paleoseismicity of the Dead Sea and Jordan Valley for seismic risk assessment.

The Ministry's Labs analyzed all kinds of natural raw materials in different methods to determine types of minerals and main components of major and trace elements. Achievements in 2016

First: Chemical and Mineral Analyses

Analyze all types of natural raw materials to determine mineral type and content of the main, secondary elements, minor and rare earth elements using X-ray spectroscopy, X-ray diffraction, plasma, atomic/graphite absorption and degree of whiteness.

The total of samples analyzed estimated around 1132 samples for various projects, 532 samples for Jordanian universities and private mining sector.

Second: Organic Geochemistry

The organic geochemistry analysis of oil shale was developed through providing the laboratories with all the necessary advanced instruments for the lab tests using:

- Oil yield retorts using Fischer Assay.
- Bomb Calorimeter to decide the calorific value resulting from sample combustion.
- Elemental Analyzer (CHNS) for Element Determination of C, H, N and S.
- A new device purchased to analyze pH soil samples.



A total of 1185 oil shale samples were received and analyzed for oil shale projects carried out and analyzed for oil yield using Fischer Assay retort, 280 samples to decide the calorific value, 216 samples for elements analyzing, and 212 samples to decide the organic carbon value. A total of 221 oil shale samples were received from the private sector companies (i.e. Questerre Jordan Company, Al Qamer for Energy and Infrastructure Ltd., Jordan Oil Shale Company JOSCO, and Jordanian Universities to decide contents of shale oil content, calorific value and other analyzing tests. Additional 3 samples were analyzed to determine conformity with OCMA DFCP-4, 2 fertilizer samples to measure sulfur content and 7 samples to measure the ratio of soluble salts and test the pH and sulfates.

Third: Soil Mechanics, Rock and Quality

- A total of 523 test samples of sand, concrete involving concrete design tests of various sizes, fracture resistance, acoustic velocity, bend coefficient, surface corrosion, density, corrosion, specific weight and absorption and determination of chlorides, sulphates and salts were all analyzed.
- Fifteen perlite samples were analyzed with granular gradients assays, moisture content and apparent density.
- A total of 117 oil shale samples were analyzed by specific weight and absorption tests, surface erosion, fracture resistance, bending resistance, speed of acoustic waves, humidity, density, and porosity.
- A total of 31 soil and volcanic tuff sample were analyzed using the hydrometer, the specific gravity and the Atterberg limit testing.
- Two calcium carbonate samples were analyzed for specific gravity and density.
- Six wood samples were analyzed for specific gravity, absorption and porosity.

Fourth: Mineral Processing and Ore Dressing

• Zeolites

The percentage of iron oxide is a high in zeolite ore. The XRD analysis shows that the main minerals are Phillipsite and Faujasite. It gives an indication that the use of magnetic separation may be worthwhile to raise the proportion of other elements. Decrease calcium (54 ppm-5 ppm) and magnesium (4 ppm-3 ppm) rates through cation exchange capacity experiments.

• Kaolin-Wadi El-Hafar-Al-Disi

Reduce impurities to increase aluminum oxides in the ore. The results of Kaolin chemical analysis shows that aluminum oxides ranged between 20-27% and from 7.50-7.95%.

Using hydrocyclone, hydrosizer and leaching methods;

1. Hydrocyclone

- Increase aluminum oxides to around 31%.
- Reduce iron oxides to around 2%



2. Hydrosizer

- Increase aluminum oxides to around 34.62%.
- Reduce iron oxides to around 1.81%.

3. Sulfuric Acid Leaching H₂SO₄

- Reduce iron oxides to around 0.83%.

Kaolin may be also used in several local industries such as porcelain, Chinese tiles, ceramics, pottery, etc.

The Ministry pursued Certificate of Accreditation ISO/IEC 17025 by Jordan Institution for Standards and Metrology JSMO, where:

- Plan 2016 involved sulfur testing, specific gravity and absorption of coarse aggregate, specific gravity and absorption of fine aggregate, relative humidity, sand equivalent and specific gravity and absorption of soil.
- Test calorific value, sulfur, carbon and hydrogen successfully.
- Adopt Plasma, hydrometer and limits of Atterberg test.

Fifth: Samples Reception and Preparation

Receive and process samples from the MEMR and public and private sectors. Consequently, minerals and other materials samples have been received, documented, given secret codes, and cost processed according to the technical specifications required through crushing, milling and sieving operations according to granular size suitable for various analyses and prepare thin section slides according to the appropriate technical specifications to be sent later on to the Directorate of laboratories to conduct chemical studies and mineral analysis needed.

A total of 2107 samples were received from public and private sectors; 1504 samples were received from the MEMR and 603 samples from public and private sectors. The total revenues from the public and private sectors amounted to around 43,856 JD.

Institutional Development

- Strategic Planning

- Update the Ministry's strategic plan 2016-2018 approved by the Minister and the planning, coordination and follow-up committee, and publish it on the Ministry's website.
- Prepare an operational plan in coordination with all organizational units to draft a recommendation appraisal report based on the results of the evaluation.
- Planned 14 workshops for all organizational units to spread knowledge about the Ministry's Plan to prepare executive plans and achieve effective awareness.
- Develop the relationship with stakeholders in accordance with a comprehensive plan to improve communication and raise satisfaction.



- Operations and Services

- Develop an operation guide by modelling best practices to document and code all operations.
- Develop relationship with customers over a customer survey to increase customer satisfaction according to best practices post approval by the Ministry of Public Sector Development, institutional development liaison officers and random customers.
- Update service guide in cooperation with the Ministry of Public Sector Development. The guide includes 59 provided services in terms of criteria stated. The guide has been uploaded to the Ministry and e-Government websites.
- Develop, print, and distribute the General Framework of the Customer Service Charter to all employees and clients.
- Study and prioritize 59 services according in terms of specific criteria such as demand density and the impact on citizens. Consequently, 3 services were selected to be funded and automated in cooperation with the Ministry of Communications and Information Technology over the next three years in re-engineering process with the Ministry of Public Sector Development to study stakeholders' accessibility to provide services and documents required.
- Handling customer complaints over announced communication channels i.e., boxes, e-mails, and government complaint system based on specific timing and methodology. In case of failing to comply with service provided, the time period was adjusted to respond any complaint within one week instead of two in compliance with the provisions of Services Development bylaw No. 156 year 2016.
- Activate the public service office and coordinate with relevant organizational units to access a range of public services easily.

- Knowledge Management

- Develop knowledge management plan which aims at embracing efficient knowledge and awareness practices.
- Develop a month visitor program and schedule 18 lectures in various domains.
- Archive 7155 explicit knowledge assets.
- Archive all confidential and protected documents for organizational units and provide the Information Council and the National Library in compliance with the Guarantee of Access to Information Law.
- Archive, develop and upload employees' implicit knowledge on the Ministry's website by modelling best practices besides adopting tacit implicit and explicit knowledge transfer.



- Innovation and Excellence

- With the aim of encouraging employees to innovate and excel, the Ministry has approved the Creative Innovation Award. Three innovative creative ideas were announced in administrative field, technical field, and one collective idea in the financial field.
- The Ministry and in response to Distinguished Employee Awards and to enforce building employees' institutional capacities has approved the Award since 2010. The Award is granted by category type to the Ministry's employees on a quarterly basis.



The Financial Statements 2016

Item	Allocations JD	Expenses JD	Disbursed Rate %
Current Expenses	9202000	8499618	92
Capital Expenses	123956000	67550682	55
Total	133158000	76050300	57

The Financial Statements of Major Capital Projects in 2016

Project	Allocations JD	Expenses JD	Disbursed Rate %
Support construction of an LNG network in the Kingdom	550000	444240	81
Oil Shale Drilling	900000	541595	60
Prospect and market petroleum resources	300000	299504	100
Oil products storage facilities	27060000	18611000	69
Utilize wind energy to generate electricity -Fujeij	2000000	2000000	100
Support projects of Jordan Atomic Energy Commission	9685000	9200750	95
The administrative project	1470000	1213939	83
Total	41965000	32311028	77

The Ministry of Energy and Mineral Resources

Tel : +962 6 5803060

Tel : +962 6 5865714

P.O.Box 140027 Amman 11814 Jordan

E-mail: memr@memr.gov.jo