JORDAN

(UPDATED 2010)

1. GENERAL INFORMATION

1.1. COUNTRY OVERVIEW

1.1.1. GOVERNMENTAL SYSTEM

Jordan is a constitutional monarchy based on the constitution promulgated on 8 January 1952. The King is the head of the state, and the supreme commander of the Armed Forces. The King exercises His powers by Royal Decree countersigned by the Prime Minister and the Minister or Ministers concerned.

Executive power is vested in the Council of Ministers which is accountable to a two house parliament. The 60 members of the Upper House are appointed by the King, while the 120 deputies of the Lower House are elected by popular vote.

The cabinet is responsible to the Chamber of Deputies on matters of general policy and can be forced to resign by a 50% or more of vote of "no confidence" by that body.

The constitution provides for three categories of courts: civil, religious, and special. Administratively, constitutional provisions define the rights and duties of Jordanian citizens, while guaranteeing the right of free worship, opinion, press, association and private property.

1.1.2. GEOGRAPHY AND CLIMATE

Jordan is a country with a total area of 89,342 square km, located in the heart of the Middle East lying between 29° and 34° north latitudes and 35° and 39° east longitudes, sharing borders with Syria to the north, Iraq to the East, Saudi Arabia to the south and Israel and Palestine to the west. The only sea port is the city of Aqaba with a coastline of 26 Km, located at the northern tip of the Gulf of Aqaba.

The topography of Jordan is mostly a desert plateau, and highlands in the western areas of arable land and Mediterranean evergreen forestry. The Great Rift Valley separates the eastern and western banks of the Jordan River, the lowest point being the Dead Sea at 415 meters below sea level, and the highest is the Um al-Dami Mountain at 1,854 m above sea level.

Jordan has a combination of Mediterranean and arid desert climates with Mediterranean prevailing in the north and west of the country, while the majority of the country is desert. Generally, the country has hot, dry summers and mild, wet winters with an annual average temperatures ranging from 12 to 25 ºC and summertime highs reaching the 40s ºC. Rainfall at most of the places in Jordan is scanty with an averages varying from 50 mm per year in the desert to as much as 800 mm per year in the northern hills, some of which

falls as snow. The rain mostly falls between November and March and the average precipitation is around 200 mm per year.

1.1.3. POPULATION

Jordan's demographic situation has changed rapidly over the last 60 years, the population is estimated to be 5.98 million at the end of 2009, representing a fivefold increase of the 900 thousand registered in 1961. The population density of the country is about 64 persons/ square km, which is rather low compared to the density in other developing countries. Population living in urban areas represents 82.6 percent of total population. About three quarters of the population reside in three areas, about 40 percent in Amman, 18 percent in Irbid, and 15 percent in Zarqa.

The considerable growth is attributed to successive waves of refugees and migrants from Palestine and Iraq over the past 60 years due to military and political turmoil, combined with the impact of a high population growth rate. The average growth rate between 1952 and 1979 had been 4.8 percent. The current population growth rate of 2.3 percent has remained constant since 2004.

A defining characteristic of Jordan's demographic profile is its youthful character. 36.5 percent are below the age of 15 years, while the productive age group (15-64 years) makes up 59.4 percent of the population. The median age of the population is

23 years. Population indices exceeding world norms include a high life expectancy of 71.6 years (men) and 74.4 years (women), and a literacy rate over 91 percent.

A decrease in the population growth rate is primarily a result of a substantial decline in total fertility rate, from 5.6 percent in 1990, to 4.4 percent in 1997 and 2.2 percent in 2009. This decline in birth rate can be attributed to the impact of considerable investment in family planning and reproductive health initiatives by the Government of Jordan accompanied with other socio-economic factors.

TABLE 1: POPULATION INFORMATION

	1970	1980	1990	2000	2005	2009	Average Annual Growth Rate (%) 2000 - 2009
Population (Millions)	1.5	2.2	3.5	4.9	5.5	6.0	2.3
Population Density (Inhabitants/km^2)	16.9	25.1	39.0	54.6	61.5	67.2	2.3
Urban Population as % of Total	-	-	78.7	78.7	82.0	82.6	0.3
Area (1000 km^2)	89.0						

Source: Department of Statistics, 2010

1.1.4. ECONOMIC DATA

TABLE 2: GROSS DOMESTIC PRODUCT

	1970	1980	1990	2000	2005	2009	Average Annual Growth Rate (%) 2000 - 2009
GDP (Millions of Current US$)	320.0	1 630.0	3 865.0	8 397.0	12 495.0	22 772.0	12.0
GDP (Millions of Constant 2000 US$)	-	4 373.0	5 314.0	8 397.0	11 454.0	14 822.0	7.0
GDP Per Capita (PPP* US$/Capita)	-	1 767.0	1 380.0	1 562.0	1 888.0	2 249.0	4.0
GDP Per Capita (Current US$/Capita)	212.0	730.0	1 114.0	1 729.0	2 283.0	3 808.0	9.0

* PPP: Purchasing Power Parity

Source: Central Bank of Jordan. 2010

1.2. ENERGY INFORMATION

1.2.1. ESTIMATED AVAILABLE ENERGY

TABLE 3: ESTIMATED AVAILABLE ENERGY RESOURCES

	Fossil Fuels			*Nuclear*	*Renewables*	
	Solid	**Liquid**	**Gas**	**Uranium**	**Hydro**	**Other Renewable**
Total Amount in Specific Units*	40 000**	-	300.00	70 000.00	-	0.00
Total Amount in Exajoules [EJ]	251.00	-	0.95	38.10	-	0.05

* Solid, Liquid: Million tons; Gas: Billion m3; Uranium: Metric tons; Hydro, Renewable: TW

** Resources of Oil Shale:

Source: Ministry of Energy and Mineral Resources, 2010

1.2.2. ENERGY STATISTICS

TABLE 4: ENERGY STATISTICS [EJ]

ENERGY CONSUMPTION*	**1970**	**1980**	**1990**	**2000**	**2005**	**2009**	Average Annual Growth Rate (%) **2000 - 2009**
TOTAL	0.01600	0.06600	0.12600	0.21300	0.28400	0.32100	8.00
- Solids* **	-	-	-	-	-	-	-
- Liquids	0.01600	0.06600	0.11800	0.20100	0.22200	0.18600	6.50
- Gases	0.00000	0.00000	0.00500	0.00900	0.05790	0.12900	18.65
- Nuclear	-	-	-	-	-	-	-
- Hydro	0.00000	0.00000	0.00017	0.00400	0.00060	0.00600	0.06
- Other Renewables	0.00000	0.00000	0.00300	0.00300	0.00300	0.00500	2.70
ENERGY PRODUCTION	**1970**	**1980**	**1990**	**2000**	**2005**	**2009**	**2000 - 2009**
TOTAL	-	-	0.00870	0.01200	0.01060	0.01230	1.80
- Solids* **	-	-	-	-	-	-	-
- Liquids	-	-	0.00070	0.00008	0.00005	0.00006	-12.10
- Gases	-	-	0.00500	0.00900	0.00700	0.00670	1.50
- Nuclear	-	-	-	-	-	-	-
- Hydro	-	-	0.00017	0.00040	0.00060	0.00060	0.06
- Other Renewables	-	-	0.00300	0.00300	0.00300	0.00500	2.70
NET IMPORT (IMP - EXP)	**1970**	**1980**	**1990**	**2000**	**2005**	**2009**	**2000 - 2009**
TOTAL	0.01600	0.06600	0.11700	0.20100	0.27300	0.30900	7.90

** Energy consumption = Primary energy consumption + Net import (Import - Export) of secondary energy.

*** Solid fuels include coal, lignite

Source: National Electric Power Company, 2010

1.2.3. ENERGY POLICY

The national energy policy aims at performing adequate energy provision for sustainable development with the least cost.

To reduce heavy burden on Jordan's economy, the future strategy is based on exploitation of all available local energy sources in an attempt to minimize reliance on imported energy as far as it is feasible. The strategy comprises from the following:

- To ensure security of supply of all energy forms and strengthening regional interconnections for electricity and gas.
- To diversify energy sources such as gradually replacing fuel oil in different industries and electricity generation.
- To enhance the utilization of local energy resources especially Uranium and Oil Shale resources.
- To increase the share of the renewable energy in the total mix of energy.
- To adopt the principles of privatization to alleviate the administrative and procedural restrictions in order to allow the private sector to invest and produce according to the market forces in a competitive environment.
- To attract international oil and gas companies to explore in Jordan
- To formulate pricing policies and improve pricing levels and structures.
- To reform the petroleum sector by liberalizing petroleum, rationalizing pricing and tax structure and dismantling monopoly.
- To promote energy efficiency to reduce energy intensity and rationalize demand growth.

Jordan aims to produce about 39 percent of total energy needs from local resources by 2020 according to Energy Sector Strategy (2007).[1] It entails enhancing renewable energy efficiency projects from 1 percent to 10 percent by 2020, utilizing oil shale to generate electricity and produce motor and heating fuel from 0 percent to 14 percent by 2020, developing local natural gas sources and keeping it as 29 percent of the mix in 2020.

1.3. THE ELECTRICITY SYSTEM

1.3.1. ELECTRICITY POLICY AND DECISION MAKING PROCESS

The major power entity in the country, Jordan Electricity Authority (JEA), was owned by the Government. It was the main electric power monopoly for the generation, transmission and distribution of centralized grid power. To promote greater efficiency and sustainability in the system, a process of reforms has been started to remove government's monopoly on generation, transmission and distribution. In 2001, the Jordan Electricity Regulatory Commission (ERC) was established, which is mandated to regulate the electricity sector based on free market economic principles and thereby create a level playing field for participation of all interested stakeholders.

[1] Ministry of Energy and Mineral Resources (2007)

As a consequence of the reform process, the generation and distribution areas of the electricity market are being deregulated. Three separate generation companies and three distribution companies were established for the various parts of the country. These would be individually licensed, while only the transmission area would remain under the government controlled National Electric Power Company (NEPCO).

1.3.2. STRUCTURE OF ELECTRIC POWER SECTOR

Electricity Sector Regulatory Commission (ERC)

The Electricity Regulatory Commission is a financially and administratively independent commission; ERC was established based on the Council of Ministers decision issued on 15/1/2001 and according to Electricity Law no.64 for the year 2002. The main objective of ERC is to ensure applying the rights of consumers and to resolve any complain that may occur between the consumer and Electricity companies.

ERC responsibilities include the following:

- To license the entities engaged in generation, transmission, supply, distribution and operation of the power system.
- To organize the generation, transmission, supply, distribution and operation of the power system.
- To determine the electric tariff, subscription fees, first-time deposits, the fees for services and the cost of connection for the transmission and distribution system.
- To participate in the development of standard specifications for electrical equipment and Installations.
- To participate with the concerned parties to ensure the implementation of environmental standards.
- To apply the government policy of restructuring the electricity sector on the bases of equity and fairness.
- To ensure that electricity companies are providing high quality safe services.
- To provide electricity services with acceptable competitive prices
- To overview, monitor and address complaints by consumers.

National Electric Power Company (NEPCO)

National Electric Power Company is considered to become the natural and legal successor to Jordan Electricity Authority which was established in accordance with special Decree No. (21) of 1967 with an independent financial and administrative existence. In order to enable the new company to perform its activities, 1996 Decree No (10), subsequently amended by Decree No (13) of 1999, was issued to regulate the electricity sector in Jordan. Accordingly, the National Electric Power Company was restructured into three separate companies. The government maintained the ownership of the activities of

transmission, power control, power purchase and sale and power exchange with neighboring countries. NEPCO's activities include the following:

- To plan, construct, develop, operate and maintain the power system.
- To purchase electrical energy from various sources and sell it to distribution companies and large consumers (Single Buyer).
- To procure natural gas for power stations.
- To maintain a safe and economic operation of the power system.
- To import and export of electric power.
- To award contracts for new generation capacities.

Central Electricity Generating Company (CEGCO)

The operation of the Central Electricity Generating Company (CEGCO) started on 1/1/1999 as a public company stemming from the governmental policies related to restructuring the electrical sector. On September 20th, 2007 CEGCO was privatized. Energy Arabia (Enara), a company established by Jordan Dubai Energy, the energy investment arm of Jordan Dubai Capital, announced the purchase of 51 percent of total shares, the Government of Jordan retained 40 percent and the remaining 9 percent shares were transferred to the investment unit of the Social Security Corporation. CEGCO currently owns about 1600 MW of generation capacity and its activities include power generation, operation and maintenance of their power plants.

Samra Electric Power Generation Company (SEPGCO)

Samra Electric Power Generating Company (SEPGCO) was established and owned by the Jordan government in August 27th, 2003 under the provisions of the Corporations Law No 22 for year 1997. SEPGCO currently owns 500 MW generation capacity and its activities are similar to that mentioned in CEGCO's section.

AES Jordan PSC Company

In April 2007, AES expanded its operations into Jordan, where it is constructing the country's first independent power project, a 370 MW combined cycle gas-fired (CCGT) power plant located on the boarders of Amman. The project, called AES Jordan PSC (also known as the Amman East Power Project) started commercial operation in September 2009.

Jordan Electric Power Company (JEPCO)

Jordan Electric Company (JEPCO) was established by the private sector in 1938. JEPCO is an electricity distribution company with a concession that covers the central part of Jordan. The concession gives the rights to JEPCO to distribute electricity in an area that includes major cities such as Amman, Zarqa, Salt and Madaba.

Irbid District Electricity Company (IDECO)

Irbid District electricity Company (IDECO) was established in 1957. It is operating under concession agreement and electricity license which granted IDECO the

exclusive right to distribute, and supply electricity in the northern region of Jordan, which include Irbid, Jarash, Ajloun and parts of Balqa district. The company has been privatized by selling 55.4 percent of its shares to Kingdome Electricity Company (KEC) which is owned by Dubai Capital Company.

Electricity Distribution Company (EDCO)

Electricity Distribution Company (EDCO) was established in 1998 as a public shareholding company. The company operates under concession law which granted EDCO the exclusive right to distribute and supply electricity in the southern region of Jordan. EDCO was privatized in 2008 by selling 100 percent of its shares to Kingdome Electricity Company (KEC) which is owned by Dubai Capital Company.

1.3.3. MAIN INDICATORS

TABLE 5: ELECTRICITY PRODUCTION, CONSUMPTION & CAPACITY

Capacity of Electrical Plants [GWe]	**1980**	**1990**	**2000**	**2005**	**2009**	Average Annual Growth Rate (%) **2000 - 2009**
TOTAL	0.300	1.047	1.673	2.018	2.662	5.00
- Thermal	0.300	1.040	1.661	2.005	2.645	5.00
- Hydro	-	0.007	0.010	0.012	0.012	2.00
- Nuclear	-	-	-	-	-	-
- Wind	-	0.000	0.001	0.001	0.001	0.00
- Other Renewables	-	-	0.001	0.001	0.004	17.00
Electricity Production (TWh)	**1980**	**1990**	**2000**	**2005**	**2009**	**2000 - 2009**
TOTAL**	1.070	3.637	7.378	9.654	14.272	8.00
- Thermal	1.070	3.626	7.333	9.589	14.203	8.00
- Hydro	0.000	0.011	0.039	0.057	0.059	5.00
- Nuclear	-	-	-	-	-	-
- Wind	0.000	0.001	0.003	0.003	0.003	0.00
- Other Renewables	0.000	0.000	0.003	0.005	0.007	10.00
Total Electricity Consumption (TWh)	**1980**	**1990**	**2000**	**2005**	**2009**	**2000 - 2009**
TOTAL	0.877	3.089	6.133	8.712	11.956	8.00

**Electricity transmission losses are not deducted.

Source: National Electric Power Company (2010)

TABLE 6: Energy Related Ratios

	1970	**1980**	**1990**	**2000**	**2005**	**2009**
Energy Consumption Per Capita (GJ/Capita)	10.6	29.6	36.3	42.5	53.8	54.2
Electricity Consumption Per Capita (kWh/Capita)	-	482.0	1 054.0	1 472.0	1 939.0	2 427.0
Electricity Production/Energy Production (%)	-	-	-	33.4	34.0	44.0
Nuclear/Total Electricity (%)	-	-	-	-	-	-
Ratio of External Dependency (%)**	-	99.0	97.0	97.0	97.0	97.0

**Net import / Total energy consumption.

Source: National Electric Power Company & Ministry of Energy and Mineral Resources, 2010

2. NUCLEAR POWER SITUATION

2.1. Historical development and current organizational structure

2.1.1. Overview

Historically, the Jordan Nuclear Energy Commission (JNEC), an agency whose board of directors was chaired by the Minister of Energy and Mineral Resources, was involved in developing a national strategy for the introduction of civilian nuclear power in the energy mix.

In order to prioritize the development of nuclear power, a High Level Ministerial Committee chaired by the Prime Minister was established in November 2006 to explore and marshal national efforts for the introduction of nuclear power in the country. The Committee produced a "roadmap" which outlined the strategic goals and activities to be undertaken to implement a nuclear power programme. In essence, the Committee, along with a supporting Technical Group, drawn from various ministries and agencies at the director general or deputy minister level, served the function of the Nuclear Energy Programme Implementing Organization (NEPIO).

A Royal Decree to pursue nuclear power was issued in January 2007, taking into account national goals for energy security and diversification, and a desire to reduce dependence on and uncertainty of imports.

This was accompanied by the allocation of resources for planning and the enacting of National Laws (42/2007 & 43/2007) to establish guidelines and institutions, specifically the Jordan Atomic Energy Commission and the Jordan Nuclear Regulatory Commission (JNRC).

The High Level Committee was replaced by an inter-ministerial committee in 2009, chaired by the Minister of Planning and included ministers of Energy, Environment, Finance, Water and Irrigation Ministries, in addition to Chairman of JAEC and DG of JNRC. In 2010, a new High Level Committee, chaired by the Prime Minister, has been formed, replacing the previous inter-ministerial committee, and in July 2010, decided to establish a NEPIO Steering Committee. A white paper to outline the country's nuclear energy policy is also under preparation.

2.1.2. Current organizational chart(s)

The national organizational structure for the implementation of the nuclear power programme is depicted in Figure 1. As shown in Figure 1, the JAEC has the direct responsibility for the development and implementation of the nuclear power programme. The Jordan Nuclear Regulatory Commission regulates, monitors, controls and issues licenses for applications of nuclear energy to ensure nuclear safety and security. Both JAEC and JNRC report to the Prime Minister (PM).

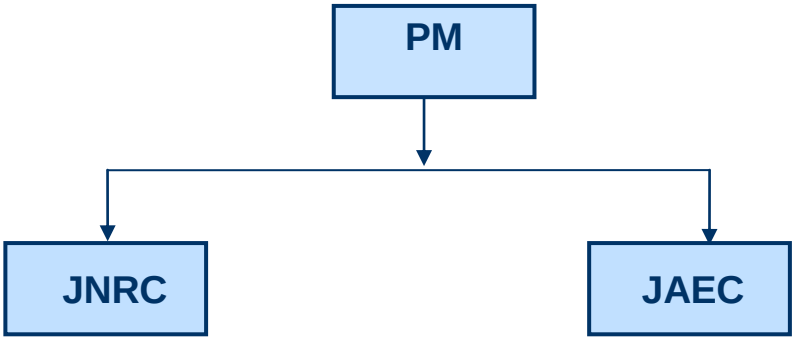

Figure 1

2.2. Nuclear power plants: Overview

2.2.1. Status and performance of nuclear power plants

NOT APPLICABLE

2.2.2. Plant upgrading, plant life management and license renewals

NOT APPLICABLE

2.3. Future development of Nuclear Power

2.3.1. Nuclear power development strategy

The uncertainty of energy supplies and their increasing costs are severely affecting the growth of Jordan's economy and the security of energy supplies. Presently, Jordan imports more than 95 percent of its energy needs. Hence, the development of secure alternative energy supplies is a top priority. Jordan has limited options to substitute for oil products. The main option is imported natural gas which is a short to mid-term option and cannot be relied upon for the long term. Consequently, natural gas should be used as a peaking source in the future. Renewable energy will be developed to the fullest possible extent. Oil shale is a medium term solution that generates electricity with limited capacity

Jordan's nuclear strategy aims to ensure the security of energy supply including fuel, to leverage the national uranium asset, to promote Public/Private Partnerships (PPP), to ensure effective technology transfer and national participation in all phases for electricity production and water desalination and eventually hydrogen production. Additionally, this strategy seeks to develop spin-off industries enhancing electricity export and enabling competitive energy-intensive industries.

In brief, Jordan has a five-point nuclear energy strategy:

a. Rely on nuclear power to meet an increasing demand for electricity and drinking water.

b. Fuel a nuclear power programme with indigenous uranium available in natural deposits and in phosphates.

c. Manage steps of the nuclear fuel cycle, including waste management, in accordance with international standards.

d. Invest in national human resources development to support the nuclear programme.

e. Secure funds for nuclear energy development without placing undue financial burden on the treasury.

In December 2009, the JAEC selected WorleyParsons to provide two-year pre-construction consulting services. The scope of work includes feasibility and financial assessment, technology assessment and selection, and the preparation of utility organization structures.

JAEC has defined a set of general criteria for selection of reactor technologies covering safety & reliability, simplicity, fuel cycle and waste consideration, economics, nuclear desalination, cooling water requirement, and technology transfer for reactors of Generation III/III+ designs in the size range of 700-1200 MWe. It also established a technology assessment strategy:

- Evaluate in detail the technologies of interest in accordance with approved procedure and evaluation criteria.
- Select the top three technologies based on technical and financial parameters to carry forward into a competitive dialogue process.
- Implement a competitive dialogue process with the three selected reactor technology providers.

Three nuclear reactor technology providers were selected in May 2010. Currently JAEC is conducting a competitive dialogue with all three vendors and potential operators/investors.

The preferred vendor/investor operator consortium will be selected in late 2010/early 2011, with the start of construction in 2014, and the start of commercial operation by 2019/2010. The project implementation plan is shown in Figure 2.

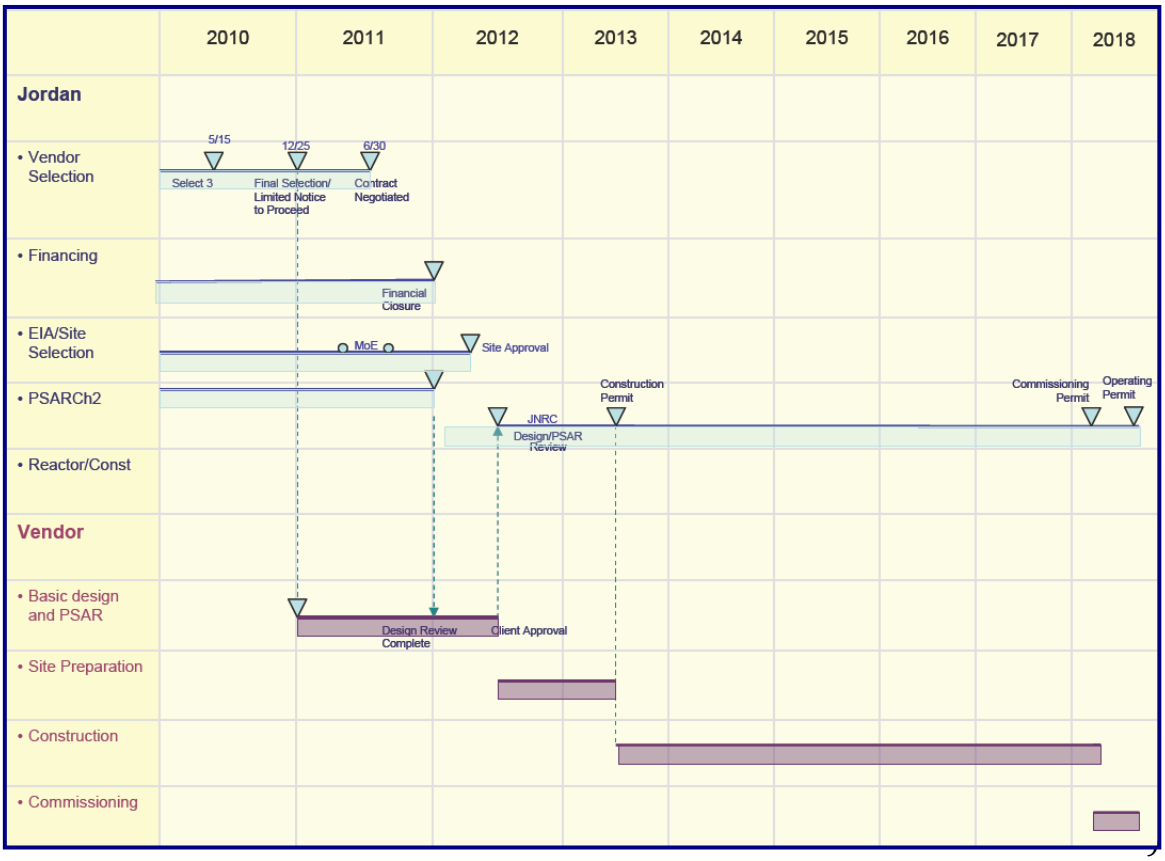

Figure 2

TABLE 8: PLANNED NUCLEAR POWER PLANTS

Station/Project Name	*Type*	*Capacity [MWe]*	*Expected Construction Start Year*	*Expected Commercial Year*
JNPR-1	PWR or PHWR	700-1100 MWe	2014	2019/2020
JMPR-2	PWR or PHWR	700-1100 MWe	2015	2020/2021

2.3.2. Project management

JAEC acts as the effective NEPIO for Jordan. The organizational structure of the JAEC is shown in Figure 3.

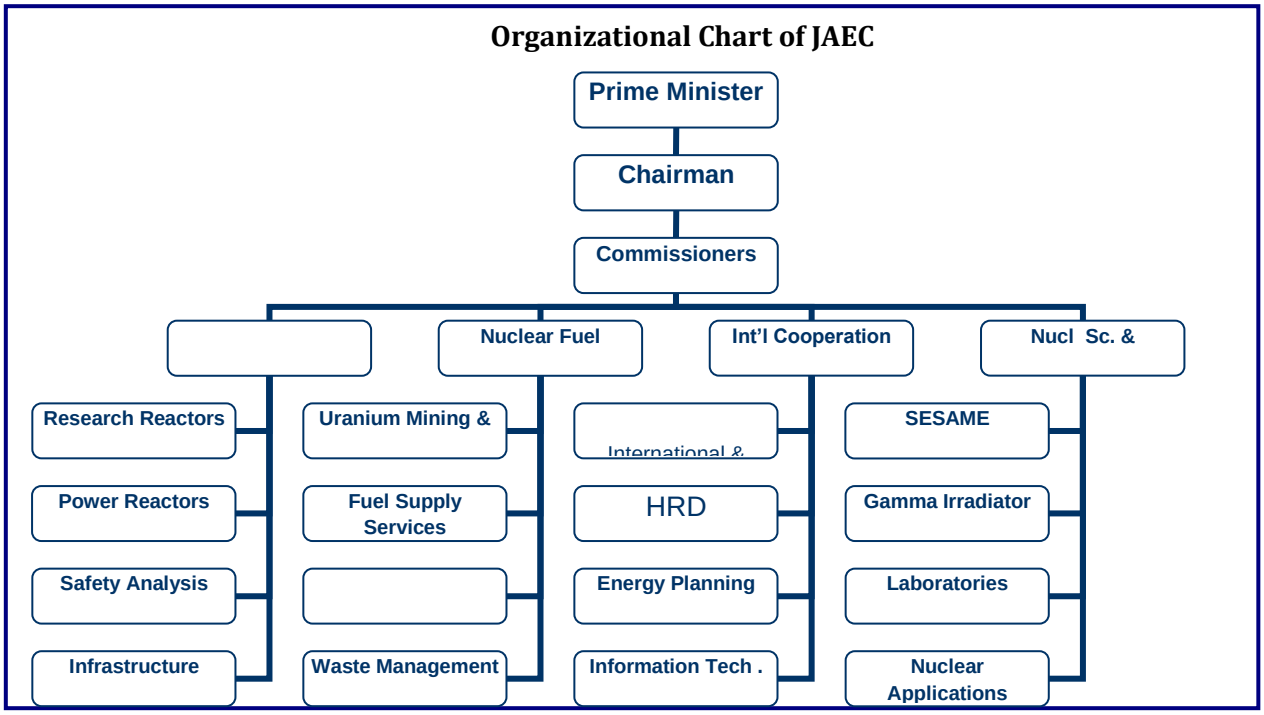

Figure 3

2.3.3. Project funding

JAEC has been exploring various options to fund and finance a nuclear power plant. Jordan expects to exploit the uranium resources to provide part of the funding or financing for the NPP. Currently, the government is funding all of the pre-construction activities for the project. The government is also expected to acquire a majority share of the equity of the NPP and to guarantee a long-term power purchase agreement (PPA).

Jordan is inclined to pursue a Public-Private Partnership (PPP) but is also exploring other options, such as a “build-own-operate” (BOO) or a “build-operate-transfer” (BOT) plan.

Under either approach, Jordan will contract much of the short-term responsibility (5-10 years) for plant operation and maintenance to the international operator. But, in the long-term, Jordan will develop these capabilities locally. The proposed structure of the nuclear utility is shown in Figure 4.

Proposed Structure of Nuclear Utility

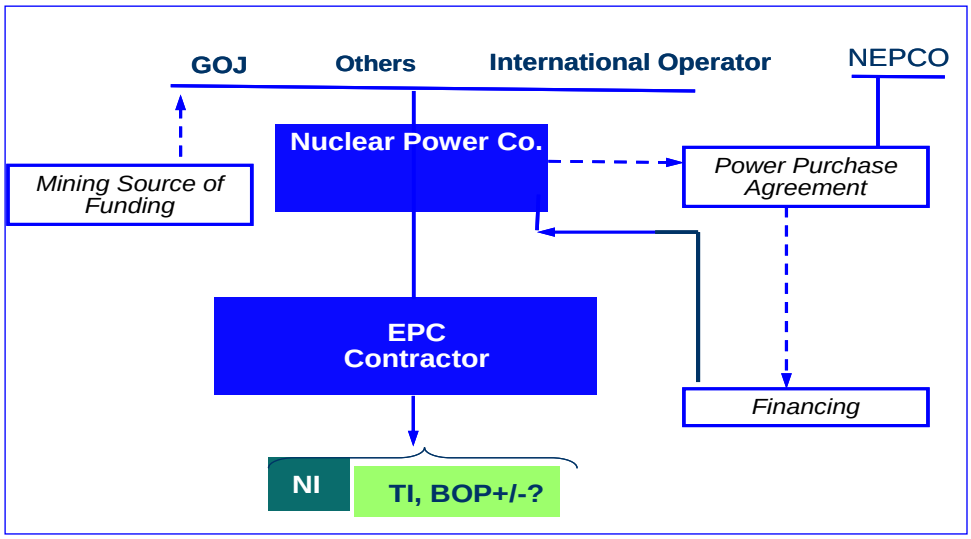

Figure 4

2.3.4. Electric grid development

Jordan is planning to acquire a 700 to 1200 MWe reactor to be operational by 2019/2020. Jordan has started site characterization studies, securing funding, selecting a vendor and developing a workforce.

Jordan’s electrical grid of 2400 MWe which will reach 5000 MWe by 2020

(See Figure 5), is relatively small and may be able to support a 1000-1200 MWe reactor by taking the following measures:

1. Interconnecting with north Saudi Arabia
2. Upgrading the interconnection with Egypt and Syria
3. Upgrading the interconnection with the West Bank
4. Signing a long term electricity export agreement with neighboring countries
5. Using the nuclear reactor for dual use including seawater desalination.

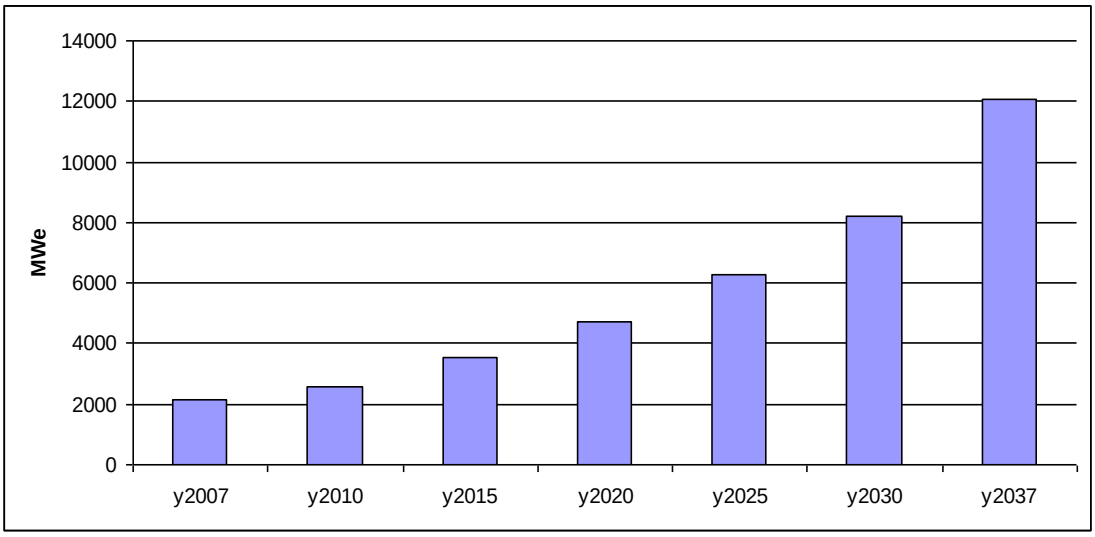

Figure 5

Jordan's electricity grid is currently interconnected with Libya, Egypt, Lebanon, Palestine, Syria and Turkey, and may be connected to Iraq and Saudi Arabia in the future. With the exception of Saudi Arabia, these countries participate in grid sharing through a multi-party agreement. Jordan welcomes the idea to connect to the integrated grid of the Gulf Cooperation Council – Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and UAE – in the future. Jordan's present electricity grid interconnection is shown in Figure 6.

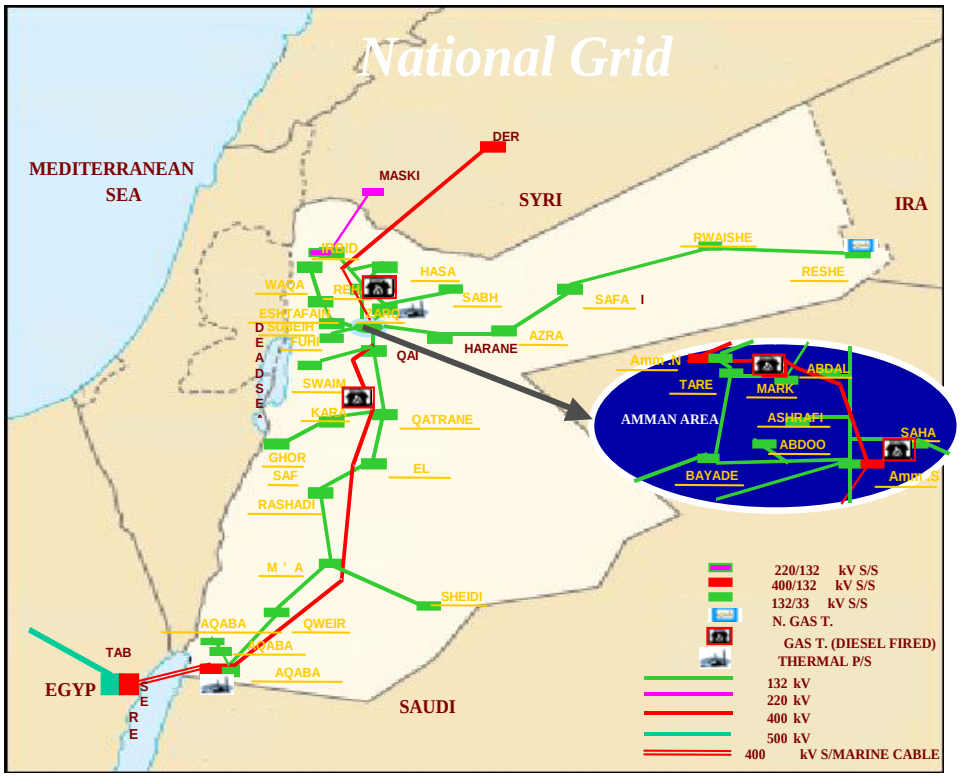

Figure 6: Current Electric Grid and Interconnection

2.3.5. Site Selection

The port city of Aqaba (referred to as “Al ‘Aqabah” in Figure 7) has been selected for the plant site for the first NPP in Jordan. This region was selected by the JAEC after screening four possible regions, namely Aqaba, Wadi Araba, Al-Khirbeh Al Samra, and Wadi Al Hammad. The other regions, with the exception Al-Khirbeh Al Samra which is under further study, were excluded due to lack of reliable cooling sources.

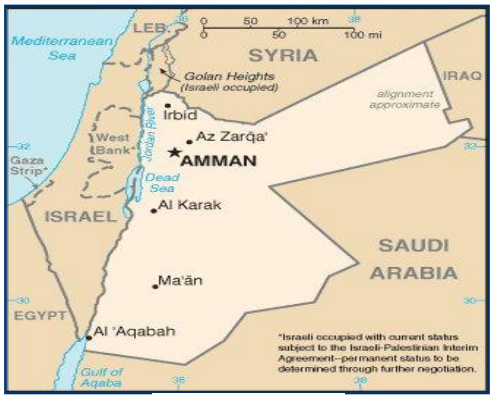

Figure 7

Figure 8

Two NPP sites in the Aqaba region (4 & 5 as shown in Figure 8) were identified for initial suitability study.

Site 4 is located approximately 6 km east of the Gulf of Aqaba coastline at an elevation of about 300 meters above sea level. It is a flat area consisting entirely of recent deposits of loose gravel, sandstone, siltstone and marl clay.

Site 5 is located approximately 9 km east of the Gulf of Aqaba coastline at an elevation of 450 meters above sea level and at the foothills of an eastern mountain ridge, which consist of granite igneous rock and gravel sediments of weathered granite debris, sandstone, siltstone and marl clay.

A desalination plant (2 & 3 in Figure 8), pumping station and other related facilities will be located on the coast of the Gulf of Aqaba, where reverse-osmosis technology will be used to supply water to the NPP.

In October 2009, the JAEC selected an international consultant to carry out a two-year assignment for the selection and characterization of the proposed site. The scope of work includes the selection of a site and all field work, laboratory testing and the engineering tasks necessary to prepare Chapter 2 of the preliminary safety analysis report (PSAR) and the environmental report (ER).

2.4. Organizations involved in construction of NPPs

The JAEC is responsible for the planning and implementation of the nuclear power projects with the assistance of external consultants.

JAEC’s policy is to leverage Jordan’s industrial capacity, in particular the Jordan construction companies, architect-engineering firms, cement and steel industries, to support the construction of the nuclear power programme.

2.5. Organizations involved in operation of NPPs

Jordan is expected to contract for much of the responsibility for plant operation and maintenance, product procurement, etc. to the operator/vendor consortium. In addition to the JAEC direct involvement in the NPP implementation programme, the operating organization will be selected with the reactor vendor. A national utility will be formed, drawing staff from conventional power utilities in addition to preparing dedicated manpower, for the operation of the NPP.

2.6. Organizations involved in decommissioning of NPPs

NOT APPLICABLE

2.7. Fuel cycle including waste management

Jordan's experience with the nuclear fuel cycle is limited to exploration of uranium ore. Jordan's uranium resources are estimated at 70,000 tons from surface deposits in addition to potential uranium extraction from the large reserves of phosphates.

Jordan established a national, JAEC-owned company named Jordan Energy Resources Inc. (JERI) in August 2007 to serve as the commercial arm of JAEC, and develop, exploit and market Jordan's natural uranium reserves (as well as vanadium, zirconium and thorium).

With respect to other nuclear-fuel-cycle related activities, Jordan is investigating various proposals for multilateral or international fuel-assurance schemes in addition to commercial deals.

The JAEC also established laboratories for analytical measurements of Uranium, signed exploration agreements with Areva to explore central-Jordan Uranium deposits and is negotiating agreements with other international companies to explore Uranium in other areas in Jordan.

Jordan is committed to managing radioactive waste in a such way to avoid the imposition of undue burdens on future generations. JAEC is aware of the issues pertaining to radioactive waste, whether for low and intermediate-level waste (LILW), spent nuclear fuel or high-level waste (HLW). The JAEC has completed in 2009 a 250 square meter interim storage facility for low level radioactive material and sources.

JAEC is currently developing a national radioactive waste management strategy in accordance with the national policy. The strategy will investigate and evaluate all options for the long-term management of spent nuclear fuel. Furthermore, JAEC is working on assessing the readiness of the various national institutions to handle the various waste issues and is taking steps to sign and bring into force the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

2.8. Research and development

2.8.1. R&D organizations

Jordan has signed recently a contract to construct both a 5 MWt multi-purpose research reactor as well as a sub-critical assembly, at the Jordan University of

Science and Technology. These facilities will be integral part of the future national centre for nuclear R&D.

2.8.2. Development of advanced nuclear technologies

NOT APPLICABLE

2.8.3. International co-operation and initiatives

Jordan is an active member in the International Framework for Nuclear Energy Cooperation (previously the Global Nuclear Energy Partnership (GNEP)).

Jordan, represented by JAEC, has been negotiating Nuclear Cooperation Agreements (NCA's) with several countries. These negotiations led to the signature of NCA's with France, China, South Korea, Canada, Spain, Argentina, Russia and the United Kingdom. Negotiations are underway to sign similar agreements with United States of America and Japan, Romania and Czech Republic.

2.9. Human resources development

JAEC strategy for human resource development is to develop the knowledge and skills needed for the human resources to support all phases of the Jordanian nuclear power programme in a timely manner.

In order to achieve the objectives, a plan for both educational and training programmes was developed as described in the following sections.

Education and Training Programmes

The education and training programme for the implementation of nuclear power entails the deployment of a multi-pronged training strategy which will include formal education in universities and community colleges; on-the-job training; facility-specific-training provided by reactor vendor organizations; direct participation during project implementation and partnerships with experienced power utility organizations for initial operation of power plants, among others.

Jordan is developing a training plan for capacity building in human resources (engineers, experts and technicians) for its nuclear programme. This should be implemented via the education system and additional professional training programmes covering the subjects related to:

- Nuclear Power (engineers, experts and technicians and other relevant personnel).
- The specialized subjects in both scientific and technical disciplines.
- On-the-job training (for personnel to experience real-time operation).

In order to achieve this national plan, the following actions are taken:

Educational Programme

The mechanism to implement this programme will be through:

i. The establishment of nuclear undergraduate programme and upgrading of master degrees in nuclear engineering and management in Jordan universities.

ii. The provision of scholarships, fellowships in nuclear fields from JAEC, Jordanian universities and other institutions in Jordan and from abroad.

iii. The establishment of a center of excellence in collaboration with advanced nuclear power countries.

iv. The collaboration with regional and international agencies such as IAEA in fields related to nuclear power and safety.

v. Postgraduate training in the best international institutes

A number of educational institutions have established nuclear studies programmes to help reach this goal. The Jordan University of Science and Technology (JUST) established a

nuclear engineering department in 2007 offering a Bachelor's degree to lead Jordan's effort in developing its nuclear energy education infrastructure, and to introduce nuclear power as part of its energy mix. The University of Jordan, Yarmouk University (YU), and Al-Balqa Applied University (BAU) have started a Master programme in nuclear physics.

The Department of Nuclear Engineering (NE) at JUST offers a five year B.Sc degree in Nuclear Engineering. JUST has also signed MOUs with several foreign universities, proposing collaboration and exchanges in nuclear engineering at institutions such as

North Carolina State University, the University of Illinois, Virginia Tech, Ohio State University, and the University of California.

JAEC made great efforts to assist JUST in developing its capabilities in its Nuclear Engineering programme. A sub-critical assembly is being purchased from China to be installed at JUST by September, 2010. A nuclear research reactor (5 MWt) will also be procured to be built at JUST. It would serve as an integral part of the nuclear technology infrastructure for education, training, and isotope production. It will also become the focal point for a Nuclear Science and Technology Center (NSTC) and allow for proper training of nuclear engineers & operators and other technicians.

Under bilateral nuclear cooperation agreements or own funding, Jordan is sending abroad new graduates and staff to receive training or complete their post-graduate education in nuclear engineering related fields. About one dozen candidates have been sent so far to France, China, Korea, and the United States.

Jordan and France have agreed and signed an MOU to establish a specialized Centre of Excellence to prepare qualified manpower for the nuclear programme. The Centre will rely on the faculties and resources of both the academic and technical institutions in Jordan. At start, the focus of the Centre would be to cover the required human resources for project managers, nuclear safety professionals, and highly qualified technicians.

Training Programme

A training plan is under development to cover:

- Fundamental & basic knowledge of NPP (Nuclear Theory, General Plant System, etc.) for new staff

- Practical and essential knowledge to improve existing and new staff's expertise (Operation, Mechanical, Electrical, I&C, Core & Fuel, Safety, etc.)
- Advanced specialized training in core areas

The mechanisms to implement this plan will be through:

- Local resources
- Contracts that JAEC negotiate
- Local involvement and technology transfer from design to operation & maintenance
- Close cooperation for training and expert visits with international Laboratories
- IAEA technical cooperation programme (Specialized training courses & workshops, fellowships programmes and OJT, scientific visits, national consultants, expert services)
- Arab Atomic Energy Commission (AAEC) training opportunities.

2.10. Stakeholder Communication

The government and JAEC are seeking input from key stakeholders at various critical phases of Jordan's nuclear power programme, as well as keeping them aware of developments. The JAEC is also informing the general public of developments through: public presentations, TV, and newspapers articles. Public hearings will be conducted at crucial phases of the programme.

3. NATIONAL LAWS AND REGULATIONS

3.1. Regulatory framework

3.1.1. Regulatory authority(s)

Jordan Nuclear Regulatory Commission (JNRC) was established in 2007 as a successor to the former Jordan Nuclear Energy Commission (JNEC), established in 2001. JNRC is effectively an independent and adequately empowered regulatory body. It enjoys administrative and financial independence (see Figure 9).

The main goals of the JNRC are to work, in coordination with relevant bodies, on achieving the following:

- Regulating and monitoring the use of nuclear energy and ionizing radiation.
- Protecting environment and human health and property from the hazards of radiation and related pollution.
- Ensuring general radiation protection and nuclear safety and security.

The JNRC has the duty of regulating nuclear materials and nuclear installations and facilities, to ensure the reliability and availability of the safety and security

conditions and requirements for nuclear materials and nuclear installations and facilities, and the

preparation of a system for inventory and accounting of nuclear materials in Jordan under the Safeguards Agreement applied by the International Atomic Energy Agency.

In regards to the current law, JNRC has the duty of preparing the legislative framework of nuclear regulations and safety instructions and guides to control the peaceful use of nuclear energy in Jordan.

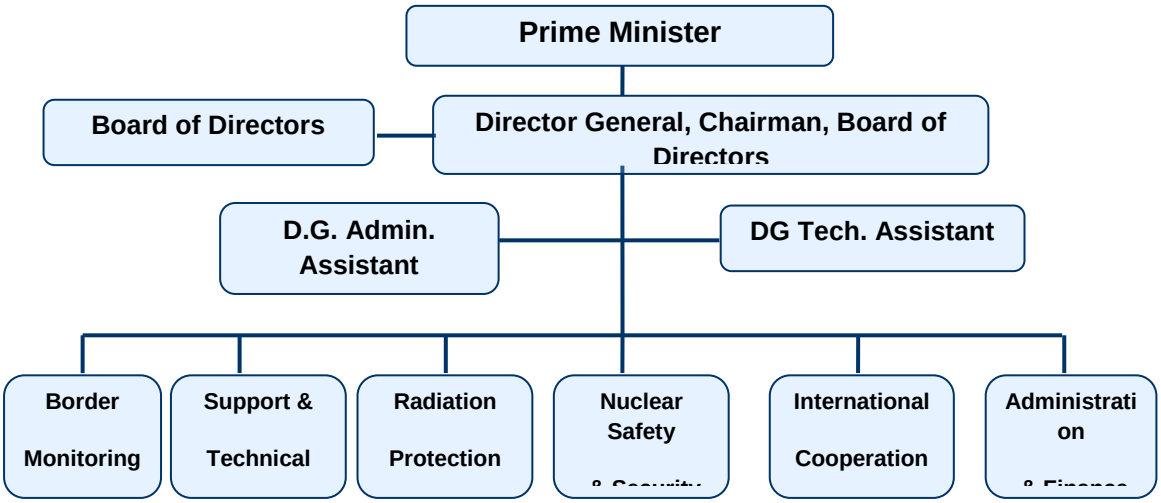

Figure 9

3.1.2. Licensing Process

The licensing processes of nuclear installations and facilities, reactor operators, management of spent fuel, and other related activities are under preparation.

3.2. Main national laws and regulations in nuclear power

In 2001, the law of Nuclear Energy and Radiation Protection (29/2001) substituted law (14/1987), and established JNEC to undertake both promotion and regulation of nuclear applications in the country.

In July 2007, the law was amended and divided into two laws allowing the creation of two independent entities the Jordan Atomic Energy Commission (JAEC) under Nuclear Energy Law (42/2007) and the Jordan Nuclear Regulatory Commission (JNRC) under Radiation Protection and Nuclear Safety and Security Law (43/2007).

In January 2008, the Parliament amended law (42/2007) empowering the Jordan Atomic Energy Commission to lead the national effort, implement Jordan's nuclear strategy, and manage the nuclear programme.

The parliament, in compliance with IAEA recommendations and with the best of international practices, empowered JNRC as an independent body to promulgate the needed legal, regulatory and security framework for the introduction of nuclear power.

The following preliminary drafts of the regulations and instructions as set out in Article 26 of the Radiation Protection and Nuclear Safety and Security Law number (43/2007), and its amendments, are under preparation:

- Regulation for Mining and Milling of Nuclear Materials;
- Regulation for the Safe Use of Nuclear Energy;
- Site Evaluation for Nuclear Installations;
- Tariff on the Fees pursuant to the Regulation on the Safe Use of Nuclear Energy;
- Regulation on the Procedure for Issuing Licenses and Permits for Safe Use of Nuclear Energy;
- Instructions on Ensuring the Safety of Nuclear Power Plants;
- Instructions on Ensuring the Safety of Research Nuclear Installations.

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APPENDIX 1: INTERNATIONAL, MULTILATERAL AND BILATERAL AGREEMENTS

AGREEMENTS WITH THE IAEA

• Agreement on the Privileges and Immunities of the IAEA	Entry into Force:	October 27, 1982
• Revised Supplementary Agreement Concerning the Provision of Technical Assistance by the IAEA (RSA)	Entry into Force:	February 5, 1989
• Application of safeguards in connection with the Treaty on Non-Proliferation of Nuclear Weapons (with Protocol)	Entry into Force:	February 21, 1978
• Protocol Additional to the Agreement between the Hashemite Kingdom of Jordan and the IAEA for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons	Entry into Force:	July 28, 1998
• Co-operative Agreement for Arab States in Asia for Research, Development and Training Related to Nuclear Science and Technology (ARASIA)	Entry into Force:	August 20, 2002

MAIN INTERNATIONAL TREATIES

• Convention on the Physical Protection of Nuclear Material	Entry into Force:	October 7, 2009

• Amendment to the Convention on the Physical Protection of Nuclear Material	Signature:	October 7, 2009
• Convention on Early Notification of a Nuclear Accident	Entry into Force:	January 11 ,1988
• Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency	Entry into Force:	January 11, 1988
• Convention on Nuclear Safety	Entry into Force::	September 10, 2009

BILATERAL AGREEMENTS*

• Jordan / France	Signature:	May 30, 2008
• Jordan / China	Signature:	August 19, 2008.
• Jordan /South Korea	Signature:	December 1st, 2008.
• Jordan / Canada	Signature:	February17, 2009.
• Jordan / Russian Federation	Signature:	May 22, 2009.
• Jordan / Argentina	Signature:	September 23, 2009
• Jordan / United Kingdom	Signature:	June 22, 2009
• Jordan /Spain	Signature:	January 27, 2010

* Nuclear Cooperation Agreement

APPENDIX 2: MAIN ORGANIZATIONS, INSTITUTIONS AND COMPANIES INVOLVED IN NUCLEAR POWER RELATED ACTIVITIES

Jordan Atomic Energy Commission

Telephone: +962 6 5230978

Fax: +962 6 5231017

E-mail: contact@jaec.gov.jo

Jordan Nuclear Regulatory Commission

Telephone: +962 6 5927124

Fax: +962 6 5927144

E-mail: info@jnrc.gov.jo

Report Coordinator: Dr. Kamal Araj

Institution: Jordan Atomic Energy Commission

Telephone: +962 6 5230978

E-mail: karaj@jaec.gov.jo