MOROCCO

(UPDATED 2010)

1. GENERAL INFORMATION

1.1. COUNTRY OVERVIEW

1.1.1. GOVERNMENTAL SYSTEM

The Moroccan political system is a constitutional monarchy with a parliamentary form of government. The king appoints the prime minister following elections. Several parties are involved in the Moroccan political field.

The legislative branch has a bicameral parliament, consisting of the Chamber of Representatives (lower house) and the Chamber of Counselors (upper house).

Morocco has an independent judiciary system headed by the Supreme Court.

1.1.2. GEOGRAPHY AND CLIMATE

The Kingdom of Morocco is located in northwest of Africa with the Atlantic Ocean in the west side and the Mediterranean Sea in the north side. It is separated from Europe by the Straits of Gibraltar. The kingdom's capital is Rabat. The national territory stretches on an area of about 711 000 square kilometers.

Fig.1. *Map of Morocco.*

The Atlantic Morocco contains the most important plateaus and plains (Abda, Gharb, and Chaouia) as well as the longest rivers (Sebou, Oum rabïe). This part of the Kingdom is the most populated (about 65%). To the north, the "Rif" chain overhangs the Mediterranean shore and stands as a natural boundary to the eastern provinces, an area with dry climate formed by sparsely populated high plateaus and the valley of the Moulouya river.

The chain of Atlas which stands up in the east and south of the Atlantic Morocco is made up of the Medium, the High (Great Atlas in Arabic, peak at Jebel Toubkal : 4 165 m) and the Minor Atlas which forms the southern boundary of the "Souss Valley".

To the South of the Minor Atlas, stretches the Moroccan Sahara dotted with oasis (Smara) and seasonal rivers (Drâa), with small inland towns and coastal modern cities (Laâyoune, Dakhla).

The Moroccan climate varies according to season and region. The north coast of Morocco and the interior mountains, the Rif, have a Mediterranean climate. The inland areas have continental climate, they are warmer and drier. In the south, the climate is hot and dry for most of the year, although the temperature can drop highly in the night, especially during the months of December and January. The rain falls from November to March in coastal areas, and the country is mostly dry with high temperatures in summer and a cooler climate in the mountains.

The north-west of Morocco in particular is exposed to Atlantic depressions in winter and rainfall is moderately high. The Atlantic coast south to Agadir receives over 200 mm of rain in winter, but further south, the climate becomes progressively drier and the Sahara Desert stretches along the coast. Rainfall increases to over 400 mm in the north of Casablanca.

1.1.3. POPULATION

The past demographic indicators of the Moroccan population are presented in Table 1. Based on the recent dynamics of the Moroccan population, an annual growth rate of 1% to 1,5% could be expected for the next decade.

TABLE 1 - POPULATION INFORMATION

							Average annual growth rate (%)
Year	1971	1980	1990	2000	2005	2008	2000 to 2008*
Population (millions)	15,379	19,380	24,167	28,466	30,172	30,841	1
Population density (inhabitants/km^2)	34	42	34**	40	42	43	0,9
Urban Population as % of total	35,2	41	48,6	54,2	55,5	56,4	0,4

Area (1000 km²)	450	710,85	710,85	710,85	710,85	710,85	0

** Latest available data (2008).*

*** including Sahara Provinces from 1982.*

Source: *Morocco Statistics Directory / Haut Commissariat du Plan.*

1.1.4. ECONOMIC DATA

Morocco has a fairly stable economy with continuous growth over the past half-a-century.

The principles economic sectors are as follow:

- Mining Sector: Morocco has considerable mining resources: He is the first phosphates exporter world-wide. The country is rich also in iron ore and non ferrous metals in the mountains: baryta, lead, manganese, cobalt, copper, iron, zinc, antimony, molybdenum, fluorine. On the other hand, energy resources (coal, oil and natural gas) are more limited and cannot stop recourse to imports.
- Agriculture: The main agricultural productions are cereals, the legumes, market gardening, fruits, and sugar plants. Fruit tree cultivation and olive trees provide an additional large resource. Animal husbandry occupies a predominant place in the agro-pastoral sector.
- Industrial Sector: this sector presents about 28% of the GDP, with food industries ranking at the top, followed by textile industries, leather and the building industry.
- Transportation Sector: Transport represents a sufficiently developed sector. Morocco has a road network of 59 474 km and a railway network of 1 893 km. The main airports are Casablanca, Rabat, Fez, Agadir, Marrakech, Tangier, Oujda, Nador and Laâyoun. The main ports are Casablanca, Mohammedia, Tangier city, Tangier Mediterranean, Dakhla and Nador.
- Tertiary Sector: The tertiary sector is dominated by tourism with 8.3 million visiting tourists in 2009.

Real GDP growth is expected to average 5,5% in the 2009 – 2013 period, taken into account the prospects in the tourism and the non-agricultural industry, as demand growth in the Eurozone — Morocco's key export market and source of tourists is projected to be more subdued.

TABLE 2 - GROSS DOMESTIC PRODUCT (GDP)

							Average annual growth rate (%)
	1970	1980	1990	2000	2005	year**	2000 to 2009**
GDP (millions of current US$)	3960	21030	28851	37022	59524	90755	9,8%

GDP (millions of constant 2000 US$)	-	-	-	-	-	-	-
GDP per capita (PPP* US$/capita)	-	1147	2035	2666	3574	4587	6,2%
GDP per capita (current US$/capita)	257,5	1085	1194	1301	1973	2943	9,4%

** PPP: Purchasing Power Parity.*

*** Latest available data (2009).*

Source:

- *International Monetary Fund (http://www.imf.org/)*
- *World Bank Website (http://datafinder.worldbank.org/)*

1.2. ENERGY INFORMATION

1.2.1. ESTIMATED AVAILABLE ENERGY

Morocco has very limited local resources of energy and depends almost totally on external sources for its energy supply.

Fossil fuels:

Local production of coal (anthracite) was provided by Jerada mine until its closure in 2000. Current needs of coal are imported.

Morocco has very large deposits of oil shale, especially in the south of the Kingdom. However, feasibility studies conducted so far for the recovery of this national resource for producing electricity and pyrolisys have shown that the use of this national resource is not yet competitive using the present technologies.

Morocco produces very small volumes of oil and natural gas from the Essaouira Basin and small amounts of natural gas from the Gharb Basin.

The country is crossed by the Maghreb Europe pipeline (of about 10 bcm/year capacity), transporting the Algerian gas to Europe through the Strait of Gibraltar. The gas royalties received by Morocco is used to feed the power plants of Tahaddart and Ain Beni Mathar.

Nuclear fuel:

Morocco has very large amounts of uranium in its phosphates. This resource could prove useful in the future if economically competitive processes are developed for its extraction. According to IAEA's recent studies, the estimated availability of uranium in the Moroccan phosphates is of about 6,9 million tons.

Renewable resources: Morocco continues to enhance its hydraulic potential for electric generation by increasing the capacity of this source. Furthermore, Morocco has a huge renewable energy potentials. Two major renewable energy programs were launched recently by the King Mohamed VI. Their general details are given below:

Solar energy program: In November 2009 Morocco announced the implementation of a solar energy program worth $9 billion. The program will

involve five solar power generation sites across Morocco and will produce 2000 MW of electricity by the year 2020.

Wind energy program: In June 2010, Morocco has also announced an ambitious wind energy program worth $3.5 billion. This program will bring wind-based installed electric capacity from a current 250 MW to 2000 MW by the year 2020.

TABLE 3 - ESTIMATED AVAILABLE ENERGY SOURCES

	Estimated available energy sources						
	Fossil Fuels			Nuclear	Renewables		
	Solid	Liquid	Gas	Uranium	Hydro	Other Renewable	
						Wind	Solar
Total amount in specific units*	-	-	-	6,9 Million Tons.	4000 GWh (~ a capacity of 3000 MW)	6000 MW	5 kWh/m^2/day
Total amount in Exajoule (EJ)	-	-	-	-	-	-	

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

Source: Annual Statistics of ONE "*Office National de l'Electricité*" and the Ministry of Energy, Mines, Water and Environment.

1.2.2. ENERGY STATISTICS

TABLE 4 - ENERGY STATISTICS

	1970	1980	1990	2000	2005	2009	Average annual growth rate (%) 2000 to year*
Energy consumption**							
- Total	**-**	**-**	**-**	**-**	**11978**	**13916**	
- Solids *(ktoe)* ***	-	-	-	-	3716	3379	
- Liquids *(ktoe)*	-	-	-	-	7582	9181	
- Gases *(ktoe)*	-	-	-	-	379	586	
- Nuclear *(ktoe)*	-	-	-	-	-	-	
- Hydro *(ktoe)*	-	-	-	-	251	668	

- Other Renewables *(ktoe)*	-	-	-	-	50	102	
Energy production							
- Total	**-**	**-**	**-**	**-**	**346**	**820**	
- Solids***	-	-	-	-	-	-	
- Liquids & Gas *(ktoe)*	-	-	-	-	45	50	
- Gases *(In 10^3 TOE)*							
- Nuclear	-	-	-	-	-	-	
- Hydro *(ktoe)*	-	-	-	-	251	668	
- Other Renewables *(ktoe)*	-	-	-	-	50	102	
Net import (Import - Export)							
- Total							

* Latest available data (2009)

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

*** Solid fuels include coal, lignite

Source: Annual Statistics of ONE and the Ministry of Energy ,Mines, Water and Environment.

1.2.3. ENERGY POLICY

1.3. THE ELECTRICITY SYSTEM

1.3.1. ELECTRICITY POLICY AND DECISION MAKING PROCESS

National policy for electricity supply is drawn by the National Utility of Electricity "ONE, *Office National de l'Electricité*" and submitted for approval to the Ministry of Energy, Mines, Water and Environment MMWE. Implementation of the policy is carried by ONE. This policy is based on the following set of strategic orientations:

- Continuation of mobilization of the national energy resources. In this regard, exploitation of the national renewable energy sources (hydraulic, wind and solar potentials) is being constantly increased. Recently, a huge national solar program was announced aiming at installing a solar production capacity of 2000MW by 2020.
- Diversification of the energetic mix. A good dosage is attained between the various types of imported fuel (coal, fuel-oil & natural gas).
- Energy optimization through recourse to high-performance production technologies (combined cycle facilities) and implementation of energy conservation measures.
- Consideration of the possibility of introducing Nuclear Energy in the midterm.

1.3.2. STRUCTURE OF ELECTRIC POWER SECTOR

The electricity sector in Morocco is a multi-players environment. The main actors in the electrical system are:

- Electricity Generation: ONE is the public producer. Since the late 1990s, some private producers participate in the national electric generation by supplying the power exclusively to ONE through Power Purchase Agreements (PPA) agreements (JLEC (coal power plant), EET (combined cycle power plant) and CED (wind park)).
- Electricity Transmission: ONE with a grid comprising a HV/VHV lines (60, 150, 225 and 400 kV) with a total length of 19 575 km and MV lines with a total length of 66 398 km.
- Electricity Distribution: Mainly ONE and some private operators in the big cities of the country (LYDEC in Casablanca, REDAL in Rabat, AMENDIS Tanger/Tetouan).
- Electrical neighborhood interconnections: Morocco has electrical interconnections with Spain (total transit capacity: 1400 MVA) and with Algeria (total transit capacity: 2900 MVA).

1.3.3. MAIN INDICATORS

Because of the structural deficit of primary energy resources, Morocco imports and continues to import oil, coal and electricity (through interconnections with Algeria and Spain) to balance its energy demand. The coal, the fuel and the combined cycle power plants are used as base load generation facilities.

TABLE 5 - ELECTRICITY PRODUCTION, CONSUMPTION AND CAPACITY

							Average annual growth rate (%)
	1970	1980	1990	2000	2005	2008*	2000 to year*
Capacity of electrical plants (GWe)							
- Thermal	0,171	0,797	1,373	3,168	3,449	3,449	
- Hydro	0,362	0,604	0,620	1,167	1,729	1,729	
- Nuclear	0	0	0	0	0	0	
- Wind	0	0	0	0,054	0,054	0,114	
- Geothermal	0	0	0	0	0	0	

- other renewable	0	0	0	0**	0**	0**	
- Total	0,533	1,401	1,993	4,389	5,232	5,293	
Electricity production (TWh)							--
- Thermal	0,592	3,219	7,398	10,771	17,540	18,649	
- Hydro	1,316	1,515	1,220	0,705	1,4119	1,360	
- Nuclear	0	0	0	0	0	0	
- Wind	0	0	0	0	0,206	0,298	
- Geothermal	0	0	0	0	0	0	
- other renewable	0	0	0	0**	0**	0**	
- Total (1)	1,908	4,734	8,618	11,477	19,158	20,307	
Total Electricity consumption (TW.h)	--	4,762***	8,864***	13,942***	19,971***	20,733***	

(1) Electricity transmission losses are not deducted.

* Latest available data (2008).

**: Solar Kits installed within the PERG program (Programme d'Electrification Rurale Global ».

*** : Electricity imported from neighboring countries and purchased from Moroccan companies which produce their own energy needs "Self Producers".

Source: Annual Statistics of ONE and the Ministry of Energy, Mines, Water and Environment.

TABLE 6 - ENERGY RELATED RATIOS

	1970	1980	1990	2000	2005	year*
Energy consumption per capita (GJ/capita)		11,087	12,483	15,505	18,694	19,188
Electricity consumption per capita (kWh/capita)	-	244,33	368,68	489,04	637,77	685,09
Electricity production/Energy production (%)						
Nuclear/Total electricity (%)	0	0	0	0	0	0
Ratio of external dependency (%) (1)						

(1) Net import / Total energy consumption.

* Latest available data (2006)

Source: *World Bank Website (http://datafinder.worldbank.org/)*

2. NUCLEAR POWER SITUATION

2.1. HISTORICAL DEVELOPMENT AND CURRENT ORGANIZATIONAL STRUCTURE

2.1.1. OVERVIEW

In the framework of the diversification policy of the energy primary sources and in compliance with governmental orientations, ONE considers the nuclear power option as one of the technically viable solutions able to meet the future electrical energy requirements of Morocco. It is in this framework that ONE in the early 1980s undertook site and technical-economic feasibility studies for the first Nuclear Power Plant (NPP) in Morocco in the context of an agreement signed with French company SOFRATOME, with the technical assistance of the International Atomic Energy Agency (IAEA).

Therefore, the site of Sidi Boulbra, located on the Atlantic coast between the cities of Safi and Essaouira, was selected and qualified as a site able to receive an NPP under the required nuclear safety conditions.

Consideration of the nuclear solution was initiated in 1984 in the form of a technico-economical feasibility and site studies which were ended in 1994. Those studies were later updated by ONE team project from 2002 to 2004 in the framework of a technical cooperation with IAEA.

2.1.2. CURRENT ORGANIZATIONAL CHART(S)

A substantial part of the institutional nuclear infrastructure is already in place in Morocco. This component of nuclear infrastructure consists of the following governmental organizations:

- **Office National de l'Electricité (ONE)**

ONE is the public utility in charge of the generation, transmission and the distribution of the electrical energy in the country. This company is also responsible of the planning and the development of the Moroccan electrical system (power plants and grid infrastructure). Therefore, ONE will be the main player in the nuclear power project.

- **The National Council of Nuclear Energy (CNEN)**

The CNEN is a governmental committee that assists the Government in setting up the national policy on the peaceful use of Nuclear Energy to contribute to the technical, social and economical development of the country.

It is governed by a council headed by the Prime Minister, and composed of representatives from different ministries. It includes three subcommittees; one dealing with coordination of nuclear activities, the second being in charge of nuclear regulation and the third dealing with the international cooperation.

This council played a major role to help issue the relevant authorizations related to the construction of the nuclear research center of Maâmora.

- **The National Commission on Nuclear Safety (CNSN)**

This national commission, created to assist, as consultant, the Ministry of Energy, Mines, Water and Environment and it is composed of representatives from national departments, as well as representatives of other independent national organizations.

All the permits regarding the safety of nuclear facilities are subject to submittal for approval to this Commission.

This Commission also played a major role to help issue the relevant authorizations related to the construction of the nuclear research center of Maâmora.

- **The National Centre of Radiation Protection (CNRP)**

The CNRP is in charge of the control, the inspection and the authorization of the use of the radioactive sources. The CNRP is a ministry of health department. It operates in the areas of medicine, industry, agriculture, research, etc...

This Center is the counterpart of the WHO (World Health Organization) and provides training in Radiation protection in collaboration with IAEA.

- **The Nuclear Safety Authority (ASN)**

The ASN is a department of the Ministry of Energy, Mines, Water and Environment (MEMEE). It deals with the control, inspection and authorization of nuclear installations. So far, the main contribution of the ASN in implementing nuclear installations in the country was the licensing of the 2 MWth TRIGA research reactor installed in the CNESTEN nuclear research center of Maâmora. This licensing activity consisted of the issuance of the construction permit, the commissioning license and recently the operating license.

Presently there is a plan to strengthen this authority by combining the Present Safety Authority (ASN) and the National Centre of Radiation Protection (CNRP) in one independent Nuclear Safety Authority (NSA) in compliance with IAEA recommendations.

The new nuclear law under signature process by the Moroccan authorities will certainly help setting up the Nuclear Safety Authority.

- **The National Centre for Nuclear Energy, Sciences and Techniques (CNESTEN)**

The CNESTEN centre has the mission to promote the use of Nuclear Energy, to help in setting up a nuclear power programme and to provide training in a variety of nuclear fields. For this purpose, the CNESTEN has constructed its nuclear research center of Maâmora which consists of TRIGA research reactor together with laboratories specialized in various technical fields. Aided with these facilities, the CNESTEN brings a major contribution in the development of the nation's future specialized nuclear techniques and manpower training.

Presently, the CNESTEN plays the role of the national center for radioactive waste management by ensuring the safe collection and safe interim storage of solid radioactive waste released by its own laboratories, industries and by national medical centres.

The CNESTEN serves, also, as the African base for the IAEA training activities provided to the French speaking African countries. Annually this center organizes a Post Graduate Educational Course in Radiological Safety in collaboration with IAEA, French Nuclear Engineering School (INSTN) and Moroccan Engineering School (EMI).

- **The Moroccan Universities**

The national universities currently provide in their educational curricula courses of nuclear physics and nuclear reactors (basics). This would participate to provide the human base out of which human resources could be selected and further trained to supply the qualified staff for the projected nuclear installations.

2.2. NUCLEAR POWER PLANTS: OVERVIEW (NOT APPLICABLE TO MOROCCO)

2.2.1. STATUS AND PERFORMANCE OF NUCLEAR POWER PLANTS

TABLE 7 - STATUS AND PERFORMANCE OF NUCLEAR POWER PLANTS

Station	Type	Net Capacity	Operator	Status	Reactor Supplier	Construction Date+	Grid Date ++	Commercial Date	Shutdown Date	UCF for year **

* UCF (Unit Capability Factor) for the latest available year (only applicable to reactors in operation).

** Latest available data

+ Date, when first major placing of concrete, usually for the base mat of the reactor building is done.

++ Date of the first connection to the grid

Source: PRIS database (www.iaea.org/pris).

2.2.2. PLANT UPGRADING, PLANT LIFE MANAGEMENT AND LICENSE RENEWALS

2.3. FUTURE DEVELOPMENT OF NUCLEAR POWER

2.3.1. NUCLEAR POWER DEVELOPMENT STRATEGY

The Moroccan governmental strategy aims at introducing nuclear power by 2020-2025. In a first step, the nuclear project will consist of 2 units of about 1000MWe each. Eventually, the introduced units could be used also for seawater desalination.

The national strategy regarding fuel procurement and radioactive wastes management has not yet been decided as it depends on elements such as reactor type, the feasibility of uranium extraction from the national phosphates, etc.

TABLE 8 - PLANNED NUCLEAR POWER PLANTS

Station/Project Name	Type	Capacity	Expected Construction	Expected Commercial

			Start Year	Year
Sidi Boulbra Nuclear Power Plant	Not known yet.	2×1000MWe		2020-2025

2.3.2. PROJECT MANAGEMENT

The establishment of an official NEPIO organisation is under consideration by the Government. A "pre-NEPIO" organisation called CRED (Comité de Reflexion sur l'Eléctronucléaire et le Dessalement) has been setting-up recently and has established a national report related to the status of national milestones infrastructures development of the NPP project as recommended by IAEA guides, in order to prepare the nuclear program implementation.

Waiting for the creation of the Moroccan NEPIO, the national organisations in charge of developing the nuclear power program are as follow:

- ONE, which is the national electrical utility, is presently the official developing organization of the nuclear project.
- Ministry of Energy, Mines, Water & Environment, acts as the nuclear regulatory body for the project. An independent regulatory authority is expected to be created in the framework of the forecasted new nuclear law.
- CNESTEN is the national entity in charge of the nuclear research & development activities. It could handle training responsibilities in the future to respond to manpower requirements of the project.

2.3.3. PROJECT FUNDING

As needed, the Moroccan government contribute to the necessary funds for the development of the required nuclear infrastructures such as the nuclear regulatory body and the manpower capacity at the academic level.

Concerning the financing of the Sidi Boulbra project, the financial scheme of the project is not yet considered. It will be studied in detail and defined later. The BOT implementation model which has been successfully used for previous power projects, particularly for Jorf Lasfar and Tahaddart power plants, will be considered for the implementation of the nuclear project.

2.3.4. ELECTRIC GRID DEVELOPMENT

The Moroccan electric grid is being continuously developped to ensure evacuation of the electricity produced both by existing, under construction and planned power plants. The necessary upgrading works will be conducted on time to ensure the safe operation of Sidi Boulbra NPP.

2.3.5. SITE SELECTION

Beginning from 1981, a large data collection was initiated by ONE at the national level to enable a siting process which was undertaken between 1984 and 1994.

The siting studies undertaken jointly by ONE and its technical consultant SOFRATOME were closely supervised by the IAEA. They resulted in the selection and full technical qualification of the site of Sidi Boulbra.

Sidi Boulbra site is lacated on the Moroccan Atlantic coast; it presents all the physical characteristics necessary for the safe and economic construction and operation of a nuclear power plant. Sidi Boulbra site could receive up to 4 units of 1000 Mwe each.

2.4. ORGANIZATIONS INVOLVED IN CONSTRUCTION OF NPPS

Not Applicable

2.5. ORGANIZATIONS INVOLVED IN OPERATION OF NPPS

Not Applicable

2.6. ORGANIZATIONS INVOLVED IN DECOMMISSIONING OF NPPS

Not Applicable

2.7. FUEL CYCLE INCLUDING WASTE MANAGEMENT

Not Applicable

2.8. RESEARCH AND DEVELOPMENT

2.8.1. R&D ORGANIZATIONS

As mentionned above, the CNESTEN with its nuclear research center laboratories is in charge of promoting the use of nuclear energy technologies, and participing also to the implementation of the nuclear power programme and providing training in a variety of nuclear fields.

- **The Moroccan Universities**

The national universities are currently involved in R&D activities related to nuclear physics and nuclear reactors, in collaboration with the nuclear research center of Maamora, foreign organizations and IAEA.

2.8.2. DEVELOPMENT OF ADVANCED NUCLEAR TECHNOLOGIES

Not Applicable

2.8.3. INTERNATIONAL CO-OPERATION AND INITIATIVES

Morocco participates to the activities of INPRO (International Project on Innovative Nuclear Reactors and Fuel Cycles) and of GNEP (Global Nuclear Energy Partnership). Other cooperation agreements are signed between Morocco and some countries.

2.9. HUMAN RESOURCES DEVELOPMENT

The national universities currently provide in their educational curricula courses of nuclear physics and nuclear reactors (basic courses). This will surely participate to provide the human resources development necessary to all the activities of nuclear project phases.

The CNESTEN participates also to the nuclear training activities. Annually this center organizes a Post Graduate Educational Course in Radiological Safety in collaboration with IAEA, French Nuclear Engineering School (INSTN) and Moroccan Engineering School (EMI).

2.10. STAKEHOLDER COMMUNICATION

Not Applicable

3. NATIONAL LAWS AND REGULATIONS

3.1. REGULATORY FRAMEWORK

3.1.1. REGULATORY AUTHORITY(S)

The Regulatory authority is a department of the Ministry of Energy, Mines, Water and Environment (MEMEE). It deals with the control, inspection and authorization of nuclear installations. So far, the main contribution of this authority in implementing nuclear installations in the country was the licensing of the TRIGA research reactor installed in the CNESTEN nuclear research center of Maâmora. This licensing activity consisted of the issuance of the construction permit, the commissioning license and recently the operating license.

As mentionned above there is a project of new nuclear law to strengthen this authority by gathering the Safety Authority (ASN) and the National Centre of Radiation Protection (CNRP) in one independent Nuclear Safety Agency (NSA) in compliance with the IAEA recommendations.

The National Centre of Radiation Protection (CNRP) is in charge of the control, the inspection and the authorization of the use of the radioactive sources. The CNRP is a ministry of health department. It operates in the areas of medicine, industry, agriculture, research, etc...

3.1.2. LICENSING PROCESS

Presently, the Ministry of Energy, Mines, Water and Environment (MEMWE) is the authority responsible for issuance, jointly with other national authorities, of permits required for the construction and operation of nuclear facilities:

- **Construction Permit** : Decree by the minister of Energy, Mines, Water and Environment
- **Permit for releasing radioactive effluents**: Joint order of the ministers in charge of Energy, Public Health, Environment and Public Works.

- **Commissioning permit:** Order of Ministry of Energy.
- **Operation permit:** Order of Ministry of Energy.
- **Shutdown permit** : Order of Ministry of Energy

The application for different licences must be submitted with the corresponding Safety Reports (preliminary, temporary and final reports).

3.2. MAIN NATIONAL LAWS AND REGULATIONS IN NUCLEAR POWER

The international treaties and conventions to which Morocco has adhered stipulate that the national legal and regulatory framework must:

a) Guarantee:

- The use of nuclear energy for peaceful purposes,
- The independence of the regulatory body vis-à-vis of all other intervening parties,
- The transparency of information,
- The compliance with international agreements and treaties.

b) Define:

- Principles and rules of authorization, monitoring, verification and inspection of nuclear facilities,
- The areas of responsibility and levels of compensation.

The national legal and regulatory framework covers the following topics.

1. *Safety of nuclear facilities*

- The earliest nuclear law promulgated at the national level is the ***Law n°005 of October, 12, 1971***, related to the *"Protection against exposure to radiation from radioactive sources used for private or public activities"*.
- The ***Decree n°2-94-666 of December, 7, 1994*** on the *"Authorization and inspection of the nuclear installations"* defined the Ministry of Energy and Mines (MEM) as the sole competent authority regulating, at the national level, the safety of nuclear facilities.
- All the laws regarding the safety of nuclear facilities are subject to submittal for approval to the ***National Commission on Nuclear Safety (CNSN)***. Furthermore, the ***Decree n°2-97-30 of October, 28, 1997*** on radiation protection appoints the Ministry of Health, represented by the "***Centre National de Radioprotection (CNRP)"***, as the only national authority in charge of ensuring radiation protection of the public and delivering permits for use of radioactive sources. This decree deals with the conditions required for radiation protection and establishes, based on the fundamental standards of IAEA and the

recommendations of the ICRP, a limit for the exposure to radiation with which the operator of a nuclear facility must conform by use of adequate measures and tools to ensure nuclear safety for its personnel and the public. This decree defines the area with limited access to a given nuclear installation, the requirements for the operator to regularly monitor the absorbed doses, to establish an emergency plan, to keep careful monitoring of all forms of radioactive releases, etc. It is planned in that same decree that all these measures will be imposed by laws developed jointly in collaboration with the Authority Body and the other concerned national entities.

2. *Delivery of Nuclear Power Plant related permits*

- ***The Decree n°2-94-666 of December, 7, 1994*** gave the authority to the Ministry of Energy, Mines, Water and Environment (MEMWE) to issue the system of permits required for the construction and operation of nuclear installations as decree, and to order or join order jointly with other national authorities.

The table below summarizes the prerequisites for each type of permit:

Type of permit	**Nature of the granted permit**	*Preliminary decisions*	*Required duration for obtaining the permit*
Construction Permit	Decree by the minister of Energy and Mines.	- National Commission for Nuclear Safety. - Provincial assembly. - Minister of the Interior. - Minister of Public Health. - Minister of Public Works. - Minister of Agriculture. - Minister of the Environment.	12 months
Permit for releasing radioactive effluents	Joint order of the ministers in charge of Energy, Public Health, Environment and Public Works.	- National Commission on Nuclear Safety.	6 months
Commissioning permit	Order of Ministry of Energy.	- National Commission on Nuclear Safety.	6 months
Operation permit	Order of Ministry of Energy.	- National Commission on Nuclear Safety.	6 months

Shutdown permit	Order of Ministry of Energy.	- National Commission on Nuclear Safety.	6 months

3. *Inspections and verifications*

   - ***The Decree n°2-94-666 of December, 7, 1994*** on the "Authorization and inspection of the nuclear installations", grants the Minister of Energy full responsibility for all the inspection works required during all the phases of the project (construction, commissioning, operational, final shutdown) and in the occasion of specific modifications that might have an impact on the safety of the nuclear facility. To this end, the Minister of Energy might appoint nuclear inspectors.

4. *Sanctions against the operator*

   By way of application of ***the Decree n°2-94-666 of December, 7, 1994*** on the "***Authorization and inspection of the nuclear installations***", the Minister of Energy can, depending on the case in question and following approval by the CNSN:

   - Either suggest to the Prime Minister, the modification, suspension or withdrawal of the Construction Permit, or,
   - Decide, either alone or jointly with other national entities, the modification, suspension or withdrawal of any one of the Permits for Commissioning, Operation, Releasing radioactive liquid and gaseous effluents and Final Shutdown.
   -

5. *Civil liability for NUCLEAR DAMAGE*

   The question of civil liability regarding possible nuclear damages is regulated by ***the Dahir n°1-04-278 of January, 7, 2005*** that promulgates ***the law n°12-02***. This law stipulates that any operator of a nuclear facility is liable for any damage caused by:

   - An accident occurring at his facility,
   - A nuclear matter that comes or emanates from, or is sent to its facility.

   This law requires also from the operator to cover all probable nuclear damages by means of financial guarantees that equal the amount of its civil liability. The details and conditions of this financial coverage are subject to approval by the concerned civil authorities. The financial amount required from the same nuclear operator for covering the nuclear damages arising from one nuclear accident is set at 100 million SDR(specify here). However, Public Administration can set a lower amount provided that in no case, the said amount is less than 5 million SDR.

   The State has the responsibility to ensure the complementary financial amount in case the insurance or financial guarantee of the nuclear operator is not enough to meet the requirements of repair for all nuclear damages. The complementary

amount ensured by the State should not, however, exceed the amount for civil liability applicable to the operator. It also has to be noted that Morocco published via ***the Dahir of May, 19, 2000***, its agreement concerning the complementary repairs for nuclear damage.

6. *Nuclear Safety*

   The national Law n°1-99-304 of November, 12, 2002, published the "Convention on the physical protection of nuclear materials", opened for signature in Vienna and New York on the 3rd March 1980.

   The Convention related to Nuclear Safety was signed by Morocco in December 1994.

7. *Radioactive waste and fuel*

   The Dahir of November, 14, 1998, promulgating ***Law n° 17-83***, gave to the CNESTEN:

   - The monopoly for importing, storing and distributing nuclear fuel,
   - The responsibility to collect and store radioactive waste in collaboration with the competent national departments.

   Also, Morocco ratified, by ***the Dahir of May, 19, 2000***, the joint agreement for the safe management of spent fuel and radioactive wastes. The aim of this agreement is to improve the level of safety in the management of spent fuel and radioactive waste.

8. *Environmental protection*

   The principal laws concerning the environmental protection are as follows:

   - ***Law n°12-03*** relating to the studies on environmental impact
   - ***Law n°13-03*** relating to the struggle against air pollution.

   Dahir of 12 July 1999 has published the protocol concerning the prevention of pollution of the Mediterranean Sea by the transborder movements of dangerous waste and their elimination.

9. *Notification of emergency situations related to nuclear accidents*

   In 1993 Morocco ratified two agreements: one concerning early notification of any nuclear accident and the other concerning assistance in the event of a nuclear accident or emergency radiological situation.

   In addition, further to the occurrence of a radioactive accident in an industrial unit in the south of Spain, which demonstrated the potential danger of radioactive contamination, the Prime Minister created in July 1998 a 'Committee for coordination and vigilance against the radioactive harmful effects'. The objective is to « establish genuine coordination between the various actors and to set up a single and reliable interlocutor for information».

   This Committee is placed under the aegis of the Department of the Environment.

10. Non-proliferation treaty and additional protocol

Morocco ratified the treaty on the Non-proliferation of Nuclear Weapons (NPT) and signed the additional protocol. Moreover, Morocco also signed an agreement with the IAEA for the application of guarantees in this regard.

Appendix 1: International, Multilateral and Bilateral Agreements

Category	Title	In force	Status
International treaties, conventions and agreements	Agreement on the Privileges and Immunities of the IAEA	1977-03-30	acceptance: 1977-03-30
	Convention on the Physical Protection of Nuclear Material	2002-09-22	Signature: 1980-07-25
	Vienna Convention on Civil Liability for Nuclear Damage		Signature: 1984-11-30
	Convention on Early Notification of a Nuclear Accident	1993-11-07	Signature: 1986-09-26
	Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency	1993-11-07	Signature: 1986-09-26 ratification: 1993-10-07
	Convention on Nuclear Safety		Signature: 1994-12-01
	Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention		Signature: 1988-09-21
	Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management	2001-06-18	Signature: 1997-09-29 ratification: 1999-07-23
	Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage	2003-10-04	Signature: 1997-09-29 ratification: 1999-07-06
	Convention on Supplementary Compensation for Nuclear Damage		Signature: 1997-09-29 ratification: 1999-07-06
	Revised Supplementary Agreement Concerning the Provision of Technical Assistance by the IAEA (RSA)	1989-03-20	Signature: 1989-03-20
	African Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (AFRA) - Third Extension	2005-06-20	acceptance: 2005-06-20
	Nuclear Treaty on the Non-Proliferation of Nuclear Weapons (NPT)		Ratification:1970

	Comprehensive Test Ban Treaty (CTBT)		Ratification:2000
	Africain Nuclear Weapon-Free Zone Treaty		Signature :1996
	Global Initiative Against Nuclear Terrorism		Active member
	Global Nuclear Energy Partnership (GNEP)		Signature 2008-10-01
	SC resolution 1540 (non-proliferation of WMD)		
	Code of conduct on safety and security of radioactive sources		
	International convention for the suppression of acts of nuclear terrorism		
SAFEGUARDS AGREEMENTS	Application of safeguards in connection with the Treaty on Non-Proliferation of Nuclear Weapons (with Protocol)	1975-02-18	Signature: 1973-01-30

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

- **Office National de l'Electricité (ONE)**

  Pole Développement/PEN

  65, Rue Othman Ben Affan 20 000, Casablanca, Maroc.

  Tel: (212) 5 22 66 84 52

  Fax: (212) 5 22 66 80 85

- **Nuclear Safety Authority**

  Direction de l'Electricité et des Energies Renouvelables
  Ministère de l'Energie, des Mines de l'Eau et de l'Environnement (MEMEE)
  Rue Abou Marwane Essaadi
  B.P. 6208

RABAT
MOROCCO
Tel: 00212 537 688774
Fax: 00212 537 688848
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- **Centre National de Radioprotection**

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  Bettana, Salé

  Tel: +212 537 81 31 83

  Fax: +212 537 81 31 84

  Morocco

  E-mail: cnrp.ma@gmail.com

- **CNESTEN**

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  10001 Morocco

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  Web : www.cnesten.org.ma

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Fax: (212) 5 22 66 80 85

Attachment 1: PREFIXES AND CONVERSION FACTORS

TABLE 1. PREFIXES

Symbol	Name	Factor
E	exa	10^{18}
P	peta	10^{15}
T	tera	10^{12}
G	giga	10^{9}
M	mega	10^{6}
K	kilo	10^{3}
H	hecto	10^{2}
da	deca	10^{1}
D	deci	10^{-1}
C	centi	10^{-2}
M	mili	10^{-3}
μ	micro	$^{10-6}$
η	nano	10^{-9}
P	pico	10^{-12}
F	femto	10^{-15}
A	atto	10^{-18}

TABLE 2. CONVERSION FACTORS FOR ENERGY

To:	TJ	Gcal	Mtoe	MBtu	GWh
From:	Multiply by:				
TJ	1	238.8	2.388×10^{-5}	947.8	0.2778
Gcal	4.1868×10^{-3}	1	10^{-7}	3.968	1.163×10^{-3}
Mtoe	4.1868×10^{4}	107	1	3.968×10^{7}	11630
Mbtu	1.0551×10^{-3}	0.252	2.52×10^{-8}	1	2.931×10^{-4}
GWh	3.6	860	8.6×10^{-5}	3412	1

TABLE 3. CONVERSION FACTORS FOR MASS

To:	kg	T	lt	st	lb
From:	Multiply by:				
kg (kilogram)	1	0.001	9.84×10^{-4}	1.102×10^{-3}	2.2046
T (tonne)	1000	1	0.984	1.1023	2204.6
Lt (long tonne)	1016	1.016	1	1.12	2240.0
st (short tonne)	907.2	0.9072	0.893	1	2000.0
lb (pound)	0.454	4.54×10^{-4}	4.46×10^{-4}	5.0×10^{-4}	1

TABLE 4. CONVERSION FACTORS FOR VOLUME

To:	US gal	UK gal	bbl	ft^3	L	m^3
From:	Multiply by:					
US gal (US gallon)	1	0.8327	0.02381	0.1337	3.785	0.0038
UK gal (UK gallon)	1.201	1	0.02859	0.1605	4.546	0.0045
bbl (barrel)	42.0	34.97	1	5.615	159.0	0.159
ft^3 (cubic foot)	7.48	6.229	0.1781	1	28.3	0.0283
l (litre)	0.2642	0.22	0.0063	0.0353	1	0.001
m^3 (cubic metre)	264.2	220.0	6.289	35.3147	1000	1