SYRIAN ARAB REPUBLIC

(UPDATED 2011)

1. GENERAL INFORMATION

1.1. COUNTRY OVERVIEW

1.1.1. GOVERNMENTAL SYSTEM

The governmental system of Syria is a republican one. The President and the members of the People's Assembly (the Parliament) are elected by direct election. The parliament has the authority –inter alia- to assess, modify and approve laws and international agreements and treaties, discuss the miniseries' policies, and adopt the general budget and development plans.

Constitution: Syria's Permanent Constitution of March 13, 1973, provides for a republican form of government described as "a democratic, popular, socialist, and sovereign state."

The Legislative Branch consists of a 250-seat unicameral People's Assembly. Members are elected by direct popular vote on the basis of single-member electoral districts for four-year terms. The last election took place in 2007 for the 9th legislative term. The functions of the Assembly include the nomination of a presidential candidate, enactment of laws, discussion of government policy, approval of general budget and development plans, and ratification of treaties.

The Judicial Branch: includes courts at three levels: courts of first instance (magistrate courts, summary courts, and peace courts), courts of appeal (one per province), and the Court of Cassation in Damascus, which serves as the highest court of appeal with the authority to resolve both jurisdictional and judicial issues. The Supreme Constitutional Court adjudicates electoral disputes and rules on the constitutionality of laws and decrees. The High Judicial Council, headed by the president and composed of senior civil judges, appoints, transfers, and dismisses judges.

Executive authority: The Council of Ministers is headed by a Prime Minister and serves collectively as the executive and administrative power of the State.

1.1.2. Geography and Climate

The Syrian Arab Republic lies on the eastern coast of the Mediterranean Sea, bounded by Turkey to the north, Iraq to the east, Jordan to the south, and by Palestine, Lebanon and the Mediterranean Sea to the West. The Total area of the Syrian Arab Republic is 185,180 sq km.

Geographically, Syria may be divided into four regions:

- The coastal region, located in the western part of the country, is bordering the Mediterranean Sea and is limited at the east side by a mountain range. The Mediterranean coastline is 193 km long.
- The mountainous region runs from the north down to the south of the country and includes all mountains and hills which are almost parallel to the Mediterranean Sea.

-The interior plains region is located to the east of the mountainous region.

-The desert region (Badia) consists of the desert plains situated in the south eastern part of the country extending to the Jordanian and Iraqi borders. The Syrian Desert is used as grazing land during sufficient rainfall.

The climate of Syria is generally of Mediterranean type, with rainy winters and dry hot summers separated by two short transitional seasons.

From a climate point of view, Syria may be divided also into four regions which coincide with the same geographic regions mentioned above. The decisive factor in this division is the amount of rainfall which is affected by the position of the ranges of the Syrian mountainous (Hermon, Anti-Lebanon, Coastal, Palmirides and Arab Mts.), together with the position of the western Lebanese (Lebanon) mountain ranges.

The coastal region is characterized by heavy rainfall in winter, a moderate temperature and high relative humidity in summer. The interior is characterized by a rainy winter season and a hot and dry season during summer. The daily differences in the maximum and minimum temperature in the interior region during summer season are high and subjected to large fluctuations. The mountainous areas with an altitude of 1000 meters are characterized by more rainy winter where rainfall may exceed 1000 mm/a and with a moderate climate in summer. The desert region is characterized by a small amount of rainfall in winter and a hot dry summer.

Relative Humidity:

With the exception of coastal areas, the atmosphere in Syria is characterized by a high rate of relative humidity during winter and a low rate during summer. As for the coastal strip, due to sea effect, the contrary is the normal case, and thus the desert and semi desert areas are those with the least relative humidity values.

During summer season the rate of relative humidity in the interior lands varies in the range of 20-50% and from 70 to 80% in the coastal strip. This rate varies during winter period from 60 to 80% in the interior regions and from 60 to 70% along the coast.

Wind:

During winter the prevailing winds in the eastern parts of the country are easterly, and in both the northern and north-western parts are northerly, while other parts of the country are subjected to westerly and south westerly winds. During summer the prevailing winds in the north eastern parts of the country are northerly, while the remaining parts of the country are subjected to westerly and south westerly winds.

Some local winds blow over a number of regions during both summer and winter for limited periods only. Thus, the north easterly winds are observed over the north eastern region, south eastern regions and south easterly winds over the middle of the desert. Homs city is known of the wind over long periods of the year as the wind speed is more than two meters per second and over more than 300 hours per year.

In this context, a report prepared by the Ministry of Petroleum and Mineral Resources pointed out that Syria is as one of the richest ten countries of the diversity of renewable energy sources. The country has 52 thousand square kilometers serve as a source of wind energy, particularly the area from Idlib and Aleppo in the north, through the area west and east of Homs, Hsia and the southern region in Daraa and Sowidaa.

The National Energy Research Centre (NERC) has recently called for bids for the design, manufacture and supply as well as transfer and secure testing and implementation of civil works, installation and operation of the equipment, machinery and equipment necessary to implement the wind farm model can (40-50) MW on the northern border of Lake Katina South - west of the city of Homs. Syria and Spain also have agreed to establish wind farm in Syria for the production of electrical energy can 50 MW to be funded by Spain.

The Ministry of Electricity has announced earlier two projects for renewable energy on the principle of partnership with the private sector in the Alheijanp "in the countryside of Damascus" and Sukhna ", situated between Homs and Palmyra, working on wind energy (100 MW). The estimated cost is about 130-150 million euros per project. The execution period of these projects are 2 years.

Air Temperature:

The daily differences between the maximum and minimum temperatures are generally quite high in most of the country. This difference reaches some times 23 °C in the interior areas, and in the order of 13 °C in the coastal regions. The daily fluctuations in temperature values are greater in the interior and desert areas as compared with the more moderate areas on the coast or the mountainous areas of high altitudes, where frequently it is around 25 °C. December and January are the coldest months of the year, while July and August are the hottest. In winter the temperature frequently falls under 0 °C but usually under -10 °C while in summer it may rise frequently up to 48 °C.

Precipitation:

Rivers and large reservoirs are mostly filed during spring seasons. During winter snow falls over all regions having an altitude exceeding 1500 m above sea level (a.s.l). Regions with an altitude of 800–1500 m a.s.l are subjected to both rain and snow. Other regions with lower altitude are usually subjected to rain, and rarely to snow, except the desert regions where even sufficient rain seldom falls.

Rain falls continually or at intervals, frequently thunderstorms accompanied by heavy showers do occur during winter. The intensity of such showers reaches in some regions 75 mm per 24 hours. The mountainous and coastal regions are the regions of heaviest rain, second in order are the northern region (north Aleppo, Qamishly and Malikieh). Most of these rains are generally due to depressions accompanied by air masses fronts coming over the Mediterranean, and when they meet the mountains they are forced to rise up and precipitate as snow and/or rain over these regions, and the other interior lands, such as the south-eastern parts and the desert regions, that receive the least amount of rain. The country from time to time is subjected to dry seasons (draught periods) and therefore the rain shortage leads to an enormous decrease in agricultural production.

1.1.3. POPULATION

The Central Bureau for Statistic (CBS) estimates the population in 2009 to 23 millions (the residents are 20125000). Up to the year 1994 the estimated average annual population growth rate amounted to 3.3%, which was one of the highest growth rates in the world. However, during the last years the growth rate has been decreased rapidly to about 2.7% in 2000, and has continued to decrease further arriving about 2.33% during the period 2000-2007. This decreasing is the result of different factors influencing the demographically situation in Syria, like changing the life style, increasing of marrying age from 26 to 29 years by male and from 20 years to 25 years by female, increasing the women share in the labour force and other factors. Recent future projection estimates the growth with about 2.14 in 2010 and 1.93 in 2020. Table 1 present selected indicators of Syrian demography during the period 1970-2007.

TABLE 1. POPULATION INFORMATION

							Average annual growth rate (%)
Year	1970	1980	1990	2000	2005	2007	2000 to 2007
Population (millions)	6.31	8.75	11.72	16.32	18.27	19.17	2.33
Population density (inhabitants/km^2)	34	47	63	88	99	104	2.42
Urban Population as % of total	43.5	46.8	48.4	51.2	53.5	53.5	0.63
Area (1000 km^2)	185.2	185.2	185.2	185.2	185.2	185.2	

* Latest available data

Source: Statistical Abstract (2005, 2007), Syrian Central Bureau for Statistic (CBS).

1.1.4. ECONOMIC DATA

The evolution of GDP by economic sectors at the constant price of 2000 is shown in Table 2. During the period 19970-2000 the Syrian economy has recorded an average annual growth rate of about 5.5%. Beginning with a period of high economic growth rate of 12.6% (1970-1975), a continuous decreasing is recorded in the next 10 years with 7.6% in 1980, 2.4% in 1985 and arriving a negative rate of –1.5% in 1990. For the last decade an average annual growth rate of about 4.7% has been achieved.

Following development of the last two years and economist estimations, the slowdown in the global economy has hit the prices of some commodities -most of the dramatic food price rises of 2008 will be reversed during 2009 and industrial materials prices will fall sharply. Foreign investment will not be as strong as previously expected owing to the global economic crisis, although there will be growing opportunities resulting from Syria's increasing economic openness and improving international relations.

TABLE 2. GROSS DOMESTIC PRODUCT (GDP)

							Average annual growth rate (%)
	1970	1980	1990	2000	2005	2006	2000 to 2006
GDP (millions of current US$)	**148**	**1115**	**5833**	**19650**	**32409**	**37146**	**11.1**
GDP (millions of constant 2000 US$)	**3900**	**9797**	**11099**	**19650**	**24670**	**25929**	**4.7**
GDP per capita (PPP* US$/capita)	**NA**	**NA**	**NA**	**NA**	**3600**		
GDP per capita (current US$/capita)	**23**	**128**	**481**	**1204**	**1774**		**71.3**

* PPP: Purchasing Power Parity, ** Latest available data

Sources:

Statistical Abstract (2007)

The Economist Intelligence Unit Limited 2009, Monthly Report February 2009, www.eiu.com,

UNDP Human development index (HDR, 2006)

1.2. ENERGY INFORMATION

The Syrian energy sector is characterized by fossil fuel dominance, absence of renewable role and full exploitation of the hydro resources. During the last decades Syria's energy supply relies on its own oil and natural gas resources. However, domestic oil production has declined rapidly during the period 1996-2005 from about 600 to 400 thousand Barrel a day. This situation escalates in view of the increase energy demand due to high demographic growth rate, socio economic changes and the achieved technological development in all consumption sectors represented by increased automation in the industry, increased mobility and car ownership and the enlarged penetration of electric equipments in the household and service sector as results of life style improvement.

1.2.1. ESTIMATED AVAILABLE ENERGY

Syrian fossil resources are limited to oil and natural gas (NG). The proven geological oil reserves are estimated to almost 24 billion barrel of oil equivalent (Bboe) of which 6.9 Bboe are extractable. Almost 4.3 Bboe have been already extracted up to 2003 and the remaining oil reserves are estimated to about 2.6 Bboe. The proven geological reserve of NG in Syria is estimated to 612 billion cubic meter (Bm3) of which 371 Bm3 are extractable. 60 Bm3 have been produced up to 2003 and the remaining reserve is about 311 Bm3. Table 3 presents the amounts of proven energy sources.

TABLE 3. ESTIMATED AVAILABLE ENERGY SOURCES

	Estimated available energy sources					
	Fossil Fuels			Nuclear	Renewables	
	Solid	Liquid	Gas	Uranium	Hydro	Other Renewable
Total amount in specific units*	NA	327	285	NA	3	

Total amount in Exajoule (EJ)	NA	13.69	10.62	NA	0.01	

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

Sources:

Energy Balance, 2005

MOM, 2009. Ministry of Oil and Mineral Resources, Reserves and expected annual productions of oil and natural gas, official letter to prime minister, Damascus (in Arabic)

1.2.2. ENERGY STATISTICS

The main indicators of Syrian energy system related to energy consumption and production are presented in Table 4.

TABLE 4. ENERGY STATISTICS

							Average annual growth rate (%)
	1970	1980	1990	2000	2005	year *	1990-2005
Energy consumption**							
- Total			0.33	0.8	1.04		8.0%
- Solids***							
- Liquids			0.26	0.45	0.67		6.5%
- Gases			0.04	0.31	0.32		14.9%
- Nuclear							
- Hydro			0.02	0.02	0.04		4.7%
- Other Renewables			0.01	0.01	0.02		4.7%
Energy production							
- Total			0.93	1.5	1.15		1.4%

- Solids***							
- Liquids			0.87	1.2	0.79		-0.6%
- Gases			0.04	0.3	0.3		14.4%
- Nuclear							
- Hydro			0.02	0.02	0.04		4.7%
- Other Renewables			0.01	0.01	0.02		4.7%
Net import (Import - Export)							
- Total			-0.6	-0.7	-0.11		-10.7%

* Latest available data

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

*** Solid fuels include coal, lignite

Source: Energy Balance (1990-2000-2005).

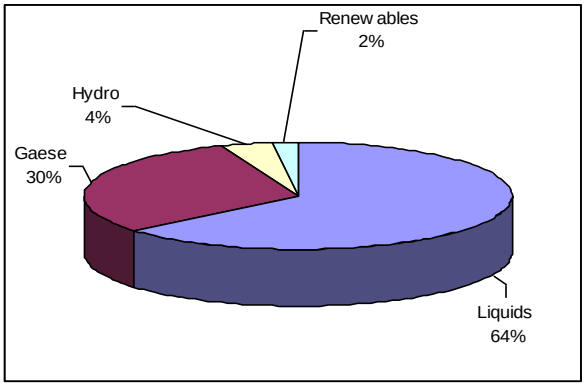


FIG.1 ENERGY CONSUMPTION 2005

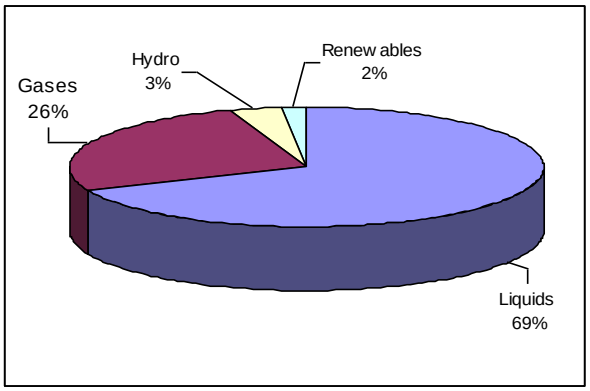


FIG. 2 ENERGY PRODUCTION 2005

1.2.3. ENERGY POLICY

The overall target of Syrian energy policy aims at ensuring supply security by providing energy services to all segments of society at cost effective and affordable prices appropriate to Syrian economic conditions. To accomplish this goal Syrian energy policy is

faced with three main challenges, namely expanding the gas market, sustaining the oil production and developing country's power capacity. To manage these challenges following general implementation measures are considered:

- Reducing the technical losses and illegal consumption,
- Supporting the introduction of energy saving and efficiency improvement,
- Encouraging the use of renewable,
- Establishing cost oriented price policy,
- Saving oil and substituting it by gas,
- Attracting foreign investment in oil, gas and power sectors.

A key challenge for the Syrian natural gas (NG) industry is logistical, with gas reserves located mainly in north-eastern Syria, while population is centred in western and southern Syria. Syrian Petroleum Company currently is working to increase Syria's gas production through several projects aiming at expanding and developing national NG network. Besides, the electricity generation policy has the priority to substitute oil by NG in the existing stations and converting NG power plants to combined cycle whenever possible. Moreover, the Government is in process to relax state monopoly over power sector. There are many efforts to reinforce the transmission and distribution of networks, and to improve the quality of customer services.

Covering future energy need in respect to the sustainable development of energy sector forms the main objective of any energy policy. Responding to the high increase of energy consumption together with the increased economic, financial and environmental burdens, Syria –like many other countries- has made noticeable efforts during the last two decades to explore possible energy conservation and efficiency improvement measures in order to reduce the energy demand on one side and substitute the exhaustible fossil fuels with renewable and nuclear alternatives on the other side. The importance of energy conservation and energy efficiency policy in the context of sustainable development has re-gained political momentum. Recent development on the energy market have seen highly volatile oil prices, increased awareness of the need for energy security, and growing energy-related environmental problems including the threat of human-induced climate change. In this context energy conservation and efficiency improvements can benefit both society and the environment by: reducing atmospheric pollution; lessening negative externalities resulting from energy production; boosting industrial competitiveness; generating employment and business opportunities; improving the housing stock and the comfort level of occupants; enhancing productivity; increasing security of supply; and contributing to poverty alleviation, among other aspects.

In order to reflect above national energy policy in the future structure of Syrian energy system in a consistent and well-organized way, comprehensive analysis has been performed covering both demand and supply side and using advanced methods like IAEA's tools (MAED, WASP, MESSAGE and SIMPACTS).

On the demand side the future long-term (up to 2030) energy and electricity demand has been projected according to different scenarios reflecting the possible future demographic, socio-economic and technological development of the country. These scenarios are constructed to cover a plausible range, in which future evolution factors affecting energy demand are expected to lie.

On the supply side a comprehensive analysis of the national energy supply options has been performed in order to formulate an adequate energy supply strategy that ensures meeting the projected future demand. The analysis depends on the integrated energy supply methodology where the whole national energy system (including all possible resources and conversion technologies) has been assessed on the basis of least-cost approach adopted in the IAEA's optimization tool MESSAGE. In this analysis all possible future supply options represented by fuel type and conversion technologies are considered to ensure supply security through diversifying the energy mix by selecting more efficient, affordable and cost-effective energy technologies, including improved fossil fired technologies, renewables and nuclear technologies. To reflect national needs in social and economic dimension, constraints have been imposed on new investments, fuel availability, energy import and export, market penetration rates and time entering for new technologies. This is essential for realistic appraisal in case of introducing renewables connected with problems of availability or in case of nuclear option that requires huge investment and preparation of national infra structure. The results indicate that nuclear option will enter the Syrian electricity generation system in 2020 with a NPP capacity of 1000 MW.

With emphasis on energy saving detailed study was prepared by GTZ for the beneficiary of the Ministry of electricity and under the support of the Atomic Energy Commission of Syria. The study was conducted in the frame work of Master plan Energy Efficiency and Renewable Energies (MEERE) project. The objective of MEERE project is to develop a plan for integrating energy efficiency and renewable energies in a sustainable long term planning for the Syrian energy sector. The recently finalized project found out that the proposed energy saving, efficiency improvement and increased renewable on the supply and demand sides of Syrian energy system will help to reduce about 25% of expected future primary energy in 2030. The achieved energy saving of 18.6 Mtoe in 2030 will be distributed to 58% for demand side and 42% for supply side. Besides, 3.8 Mtoe are fossil fuel substitution by renewables.

Furthermore, to asses the influence of climate change and impact of the Kyoto protocol on the future development of Syrian energy sector the Ministry for Environment under the support of UNDP finalized recently a project on ”Enabling Activities for the preparation of Syria's Initial National Communication to the UNFCCC”. The project deals with GHG inventory calculation of the energy sector according to IPCC guide lines, vulnerability analysis of Syrian energy sector to climate change and evaluation of future strategy to

mitigate GHG emissions. In this sense the energy sector is responsible for the most GHG emissions and inside it the sub-sector of electricity generation plays the dominant role. The proposed mitigation measures comprise energy saving and conservation, switching to a cleaner fuel, recovery of flared gases, increasing the role of cleaner generation technologies like renewables and nuclear options in the future electricity generation. The Mitigation analysis indicates that the adopted measures in the energy sector could reduce about 60 MtCO2 in the year 2030 of which about 37% would come from the power sector.

1.3. THE ELECTRICITY SYSTEM

The energy sector is part of the economic activities being administrated by the office of deputy prime minister for economic affaires. The main contributors in the Syrian energy sector are the Ministry of Petroleum and Mineral Resources, the Ministry for Electricity, the Atomic Energy Commission (AECS).

The Ministry of Petroleum and Mineral Resources produces limited amounts of electricity from gas released during the oil production process, which are being used in the operation of the oil production facilities and by the companies affiliated to the Ministry.

The Ministry of Electricity is responsible for investment, tariffs, planning, and policy formulation in the power sector. The power system is managed by the Public Establishment for Electricity (PEE), which is divided into PEEGT (Generation and Transmission), and PEDEEE (Distribution and Exploitation of Electrical Energy). PEEGT is responsible for transmission including the 400-kV and 230-kV levels, while PEDEEE supervises the 66-kV, 20-kV, and 0.4-kV levels. As a result, PEEGT has 230-kV customers, that is, large industries and irrigation. All other customers are under the responsibility of PEDEEE.

The Ministry for Irrigation is responsible for water resource management and hydro power plants. The Public Establishment of Euphrates is responsible for the three main hydropower plants of Thawra, Baath and Tishreen, all located on the Euphrates River.

1.3.1. ELECTRICITY POLICY AND DECISION MAKING PROCESS

Syrian generation sector relies mainly upon fossil fuel with an average share above 80% during the last two decades. For the future development of electricity generation system Syrian electricity policy focus on the following issues:

- Improving technical performance of existing power plants,
- Enhancing the electric load factor of the power system;
- Substituting HFO by NG;
- Enhancing the average system efficiency by increasing the share of CC;
- Increasing the share of clean technologies by encouraging renewables and nuclear options;
- Reducing technical losses and illegal consumption of distribution network.

To analyze and evaluate the future development of electricity generation sector, two future scenarios have been developed by Energy Planning Group reflecting the most favourable development trends of Syrian power sector. Both scenarios depend on the least cost expansion approach of generated electricity unit over the study period 2005-2030. The first development trend refers to the Reference Scenario (RS) that reflects the baseline development in formulating future optimal expansion plan of generation sector under a set of limits and constraints that reflect the technological features of available, committed and future power plant candidates, availability of domestic fuel resources and import and export possibilities. The second is an alternative expansion scenario, so called Clean Technology Scenario (CTS) that focuses on introducing policy measures in term of energy saving and clean technologies (renewable, nuclear, NG firing) that help in reducing GHG emissions.

Following the RS results the electricity generation will increase from 34 TWh in 2005 to about 148.4 TWh in 2030. The optimal expansion plan shows an increase of installed capacity from 6200 MW to 29600 MW. The new capacity addition is distributed to 14360 MW for CC, 12200 MW for heavy fuel fired steam power plants, 900 MW GT, 300 MW wind turbines and 1600 MW for two nuclear power plants that will enter the system in 2020 and 2025.

The optimal expansion plan of CTS shows that the installed capacity will arrive 32360 MW in 2030. The new capacity addition comprises 2000 MW for wind, 2000 MW for PV and 1000 for CSP and remaining are thermal power plans and two nuclear power plants like in RS.

1.3.2. Structure of Electric Power Sector

The final electricity demand[1] formed about 15.5% of total final energy demand in 2007. This demand grew rapidly during the period 1994-2007 arriving in 2007 about 30.6 TWh.

TABLE 5. THE ELECTRICITY DISTRIBUTION BY SECTOR OF CONSUMPTION* [1]

SECTOR	IN 2007	IN 2009
Household	52.29%	51.6%
Service	9.6%	10.8%
Industry	23.76%	23.49%
Agriculture	6.08%	7.02%

[1] Final electricity represents total generated electricity after reducing own power plant consumption, transmission and distribution losses.

Extractive Industries and Refining of Petroleum	2.53%	2.77%
Governmental Bodies, Temples and Street Lighting	4.59%	4.01%
Handicrafts and Others	1. 16%	1.02%

*Taking into consideration the illegal consumption of electricity

1 Latest available data

To face the increased demand the electricity generation increased during the period 1994-2007 form 14.88 TWh to 39 TWh. This historical development shows an average annual growth rate of 8%.

1.3.3. MAIN INDICATORS

During the period 1994-2009 the peak load demand grew from 2474 MW to 7223 MW showing an average growth rate of 7.4%. To cope with both peak load and electricity demand increase the available installed capacity increased from 3600 MW to 7518 MW (winter time, and 6500 MW in summer time). Thus, the reserve margin, which depected a high value of more than 30% in the year 2000, decreased after that gradually and the system has shown deficiet in the installed capacity in 2006 and 2007 that caused in real power shortages during the peak time. The availabel capacity in 2009 was distributed to 85% for thermal and 15% for hydro power plants. In 2009 the total generated electricity arrived about 43 TWh that was distributed to 95% for thermal and 5% for hydro generation (Table 6).

Due to the limited generation of hydro power the increased electricity demand lead to steadily increase of fossil fuel for generation purpose represented mainly by HFO and NG. During the period 1994-2009 the share of hydro power generation fluctuated heavily between 20% and 5% following the water availability in the Euphrates river. Thus, over the whole period the share of thermal generation exceed 80% and arrived in 2009 more than 95%. Hence, the fossil fuel consumption in the electricity generation –consisting of heavy fuel oil (HFO), Natural gas (NG) and small amounts of Diesel- increased from 3 to 9.3 Mtoe during the period 1994-2009. Following the available domestic NG its share in the fuel mix fluctuated significantly; it increased from 32% in 1994 to 60% in 1997, decreased to 48% in the year 2000 and increased again to 59% in 2002 and to 49.5% in 2009.

TABLE 6. ELECTRICITY PRODUCTION, CONSUMPTION AND CAPACITY

							Average annual growth rate (%)
	1970	1980	1990	2000	2005	2009	2000 to 2009
Capacity of electrical plants (GWe)							
- Thermal			1.835	4.505	5.079	6.37	3.9
- Hydro			0.550	1.067	1.150	1.151	0.9
- Nuclear							
- Wind							
- Geothermal							
- other renewable							
- Total			2.335	5.572	6.229	7.52	3.4
Electricity production (TW.h)							
- Thermal			10.636	22.714	31.49	**41.38**	6.9
- Hydro			1.59	2.5	3.45	1.95	0.97
- Nuclear							
- Wind							
- Geothermal							
- other renewable							
- Total (1)			**12.226**	**25.217**	**34.94**	**43.3**	**6.2**
Total Electricity consumption (TW.h)			8.9	18.53	27.06	32.5	6.4

(1) Electricity transmission losses are not deducted.

* Latest available data

Source: Electrical Statistical report (1999-2000)-(2005)

The capacity of Electrical Plants in 2009 was 1151 MW distributed as follows:

TABLE 7. CAPACITY OF ELECTRICAL PLANTS (MW)*

Hydro Power Plant	Winter time	Summer time
AL THAORA Plant	650	200
TECHREEN Plant	450	200
ALBAATH Plant	51	50

* Subject to the availability of water resources

TABLE 8. ENERGY RELATED RATIOS

	1970	1980	1990	2000	2005	2009
Energy consumption per capita (GJ/capita)			27.9	48.8	57.04	59.22
Electricity consumption per capita (kW.h/capita)			719.9	1458	1865	2147
Electricity production/Energy production (%)			4.4	5.9	10.7	14.4
Nuclear/Total electricity (%)			0	0	0	0
Ratio of external dependency (%) (1)			-186.3	-92.8	-11.1	-10

(1) Net import / Total energy consumption.

* Latest available data

2. NUCLEAR POWER SITUATION

2.1. HISTORICAL DEVELOPMENT AND CURRENT ORGANIZATIONAL STRUCTURE

2.1.1. OVERVIEW

The Law No. 12 (1976) promulgated the establishment of Atomic Energy Commission of Syria (AECS). In 1979, AECS assumed its duties as a governmental agency responsible for peaceful utilizations of atomic and nuclear technologies. Research departments, facilities and laboratories were founded and manned with skillful workforce towards carrying out basic and applied research in the fields of atomic and nuclear applications. AECS represents Syrian Arab Republic in regional and international gatherings related to nuclear and atomic issues. In 1963, Syria became a member of the International Atomic Energy Agency. It has fulfilled its international obligations with respect to nuclear safeguards by signing the NP treaty in 1967. AECS is complying with radiation safety regulations. The AECS is the regulatory authority in Syria. Considering a nuclear power program, AECS becomes the most appropriate organization in Syria to assess design option, establish user requirement, and prepare bid documents. Regarding country preparation to introduce first NPP, the following main achievements can be categorized:

- In the years 1980-1985, AECS in cooperation with the Ministry of Electricity initiated the first steps toward a nuclear power program. The efforts at that time accomplished a site selection study in cooperation with the Russian side. The first NPP was supposed to be a Russian design (VVER). However, after the Chernobyl accident the project was suspended.

- During the period 1999-2009, comprehensive long-term analysis of Syrian energy system has been performed aiming at projecting future final energy and electricity demand and formulating optimal energy supply strategy up to 2030. The main focus was the development of optimal expansion plan of electricity generation system to identify the optimal future generation mix and evaluate the possible role of nuclear option and the time schedule for the introduction of the first nuclear power plant on the basis of least-cost expansion. For this purpose various IAEA's analysis tools (like MAED, WASP, MESSAGE and SIMPACTS) have been employed and two technical cooperation projects with the IAEA were accomplished. The optimization results indicate that the first NPP would enter the generation system in the year 2020 with a capacity of about 1000 MW.

- During the same period, significant effort has been put for HRD and capacity building related to nuclear power project, in addition to the preparation of preliminary user requirements of NPP and feasibility study for a PWR.

- In compliance with the IAEA rules and agreements, the AECS has established Radiological and Nuclear Regulatory Office (RNRO);

- In 2009, the Higher Steering Committee for NPP has been established and has a set of responsibilities similar to NEPIO (notification to Prime Minister).

- 2009 two Committees were also established, one at the AECS dealing with regulatory, nuclear safety, environmental, hydrological aspects, and another at the Ministry of Electricity to deal with issues of technical infrastructures related to electric power plant and national grid.

2.1.2. CURRENT ORGANIZATIONAL CHART(S)

Figure 4 represents the organizational structure of the Syrian energy sector. AECS is responsible for all activities related to peaceful application of atomic energy in the fields of agriculture, medicine and industry. AECS also represents Syria's membership by the IAEA and in other related organisation. Prime Minister Decision No.6514 in 1997 details functions of the AECS as being the Regulatory Body for radiation safety in Syria. New law (legislative decree No. 64) was issued by the President of the Syrian Arab Republic. This legislative decree complies with the international standards as specified in the BSS and GS-R-1. It nominates AECS as the regulatory authority in respect to radiation protection and safety and security of radiation sources.

The utilization of electric power plants is the exclusive responsibility of ministry of electricity. Thus, the operation of possible future NPP will be also under this responsibility.

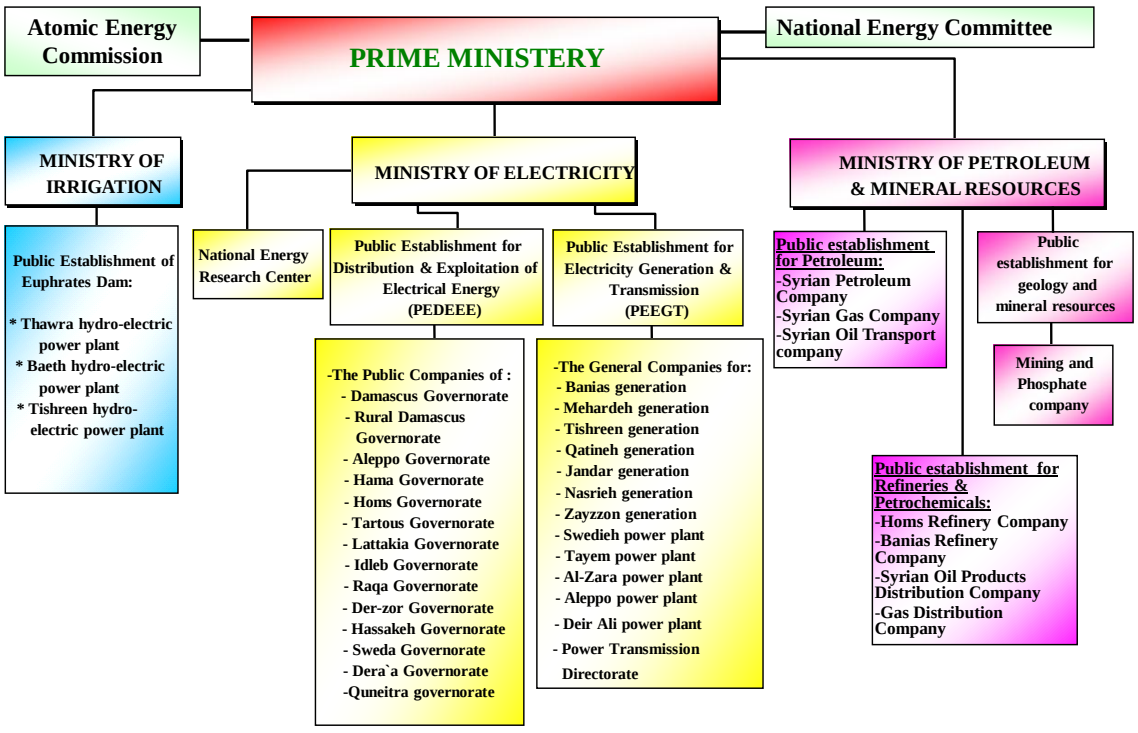


Fig 3: Organizational Structure of Syrian Energy System

2.2. NUCLEAR POWER PLANTS: OVERVIEW

2.2.1. STATUS AND PERFORMANCE OF NUCLEAR POWER PLANTS

There is no nuclear power plant in operation, under construction or decommissioned in Syria. According to the current long term energy planning studies in Syria, nuclear option

will contribute in the national electricity production in 2020. During the period 2020-2030 two nuclear reactors are supposed to be operated with a total capacity of 1600 MW.

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

Syrian energy supply strategy has indicated recently the competitive role of nuclear option in future energy supply mix. There is an acceptance and will to adopt a decision for considering nuclear option for electricity generation. This is due to the fact that recent developed supply strategy has indicated that Syria is going to face serious problems in covering its future energy supply after 2015. Meanwhile Syria has almost reasonable energy balance. However, as Syrian primary energy demand is increasing by an average rate of 5%, where at the same time oil production is steadily decreasing and NG production is limited, the country will depend more and more on energy import. In 2015 this import is expected to arrive at 16% and in 2020 to more than 45% of primary energy demands. Thus, in view of the positive supply security features of nuclear option, its introducing in the Syrian electricity generation system during the period 2020-2025 will increase supply security and mitigate possible socio-economic concerns.

However, despite all these facts, up till now there is no official decision to consider NPP as generation option.

The only one indication is the recently undertaken effort to support infrastructure development for the future nuclear power program in form of TC project with the IAEA. The on-going TC project (SYR/0/020) "Conducting a Technical and Economic Feasibility Study and Site Selection for a Nuclear Power Plant" aims at:

- Performing technical specification and economic evaluation of the most technically economically suitable nuclear power plant.
- Selecting adequate nuclear power plant depending on technical, safety, economic, financial and performance characteristics,
- Identifying site parameters affecting plant design.
- Establishing a national coordination framework for the national nuclear power programme.
- To help establish a legal framework and a national technical qualification system.
- To evaluate the Syrian development status regarding nuclear infrastructure and user requirements for introducing the first nuclear power plant.

The first NPP is expected to be turnkey project with some national participation. However, there is no policy for fuel supply or spent fuel storage. It is expected that these issue will find a solution in the framework of the ongoing international efforts leaded by IAEA to

solve the problem of nuclear fuel supply and spent fuel disposal for new counties embarking adopt nuclear power program for peaceful application.

2.3.2. PROJECT MANAGEMENT

As already mentioned the introduction of the first NPP will be managed mainly by AECS in cooperation with the Ministry of Electricity. No NEPIO has been established as per IAEA Guide. However, the Higher Steering Committee for NPP has been established in 2009, which has a set of responsibilities similar to NEPIO (notification to Prime Minister). Besides, two committees were also established in 2009, one from AECS that is responsible for reactor engineering aspects, regulatory, nuclear safety, and nuclear fuel cycle issues etc. The other is from the Ministry of Electricity to deal with issues of technical infrastructures related to electric power plant and national grid.

AECS produced recently (in 2008 and 2009) two technical reports dealing with the main criteria for selecting future NPP in Syria. Old documents are also available at the Ministry of Electricity (MOE). However, these reports are from the year 1980 and dealing with Russian NPP design.

It is recognized in case of Syria that there is an understanding of the required national strategy for accomplishing phase 1 and phase 2 for introducing first NPP. Preliminary drafting on "User Requirements" for introducing 1st NPP is prepared and can serve as a starting point for a comprehensive report.

2.3.3. PROJECT FUNDING

It is expected that the funding of the first NPP will be allocated by the Syrian Government with possible support from external regional funding sources. However, financial and economic evaluation could be one of the important outputs of the ongoing TCP SYR0020 project with the IAEA.

2.3.4. ELECTRIC GRID DEVELOPMENT

Present and future Syrian electric grid capacity is adequate to incorporate NPP as a base load. However, present grid stability needs further improvement. Regional interconnection with 7 Arab countries in addition to Turkey is available now. In the next 10 years the electric grid interconnection around the Mediterranean will be accomplished.

2.3.5. SITE SELECTION

As already mentioned several documents from a previous study for site specification and Environmental Impact Assessment (EIA) are available. However, they need detailed review and evaluation. According to EIA, AECS is responsible and has good expertise.

2.4. ORGANIZATIONS INVOLVED IN CONSTRUCTION OF NPPS

It is an ongoing investigation in the framework of the ongoing TCP SYR0020 project with the IAEA, as the objectives of the project are to perform technical specification and economic evaluation to obtain the most technically beneficial and economically

advantageous nuclear power plant, to select the most favourable nuclear power plant depending on technical, safety, economic, financial and performance characteristics, and to identify site parameters affecting plant design. Also, the project aims to establish a national coordination framework for the national nuclear power programme, to help establish a legal framework and a national technical qualification system, and to evaluate the Syrian development status regarding nuclear infrastructure and user requirements for introducing the first nuclear power plant.

2.5. ORGANIZATIONS INVOLVED IN OPERATION OF NPPS

It is expected that the first NPP will be operated by the Establishment for Electricity Generation and Transmission at Ministry of Electricity.

2.6. ORGANIZATIONS INVOLVED IN DECOMMISSIONING OF NPPS

Not applicable at this stage

2.7. FUEL CYCLE INCLUDING WASTE MANAGEMENT

Not applicable in term of nuclear fuel management. However, there is limited experience in dealing with radiological wastes of medical and industrial applications By AECS. Besides, basic understanding on the implication and handling of radioactive waste is available by the AECS. However, it is required to update related policy, strategy, and plans.

2.8. RESEARCH AND DEVELOPMENT

2.8.1. R & D ORGANIZATIONS

The research infrastructure at the AECS is especially devoted to the research programs addressing the peaceful application of nuclear energy. The AECS is responsible for determining the basis of the national policy and the related plans and programs regarding the peaceful utilization of atomic energy in Syria. This includes executing and supporting research, analysis and studies that might lead to nation's scientific, technological and economical development related to the utilization of atomic energy; establishing research and training centres, laboratories, test facilities, educating the personnel in the nuclear field and make cooperation with the universities and related organizations; preparing and implementing the decrees and regulations to determine the basis for the nuclear and radiological safety.

The AECS undertakes the research duty by performing experimental and theoretical studies at its laboratories and by making projects with international and local institutions. This includes R and D activities related to:

- Reactor physics and shielding calculation using adequate analysis tools;

- Thermal hydraulic and reactor safety analysis with special emphasis on research reactors;
- Reactor kinetics to measure selected MNSR kinetic parameters;
- Radiation protection with main focus on medical and industrial applications;
- Advanced NDT expertise with application in oil and other industry branches;
- Activities related to medical radio isotope production.

2.8.2. Development of Advanced Nuclear Technologies

Not applicable.

2.8.3. International Co-operation and Initiatives

The most cooperation activities related to nuclear applications are performed by the AECS in cooperation with the IAEA. Thus, over the last three decades AECS implemented Technical Cooperation and Coordinated Research projects with the IAEA. AECS received many IAEA experts in different fields, like energy planning, research reactors INSAR mission, radiation protection and radiological regulatory.

Besides, the TC and (CRP) programmes of the IAEA proved to be important tools for promoting national research activities in different fields of interest in nuclear technology. The following are relevant TC and CRP projects implemented during the last decade:

- TC-Project (SYR/006) on Analysis of Energy and Electricity Demand Projection in Syria (Covering the period 1999-2030);
- Comparative Assessment of Electricity Generation Options (RAS/0/043)
- Technical and Economic Feasibility Study and Site Selection for a Nuclear Power Plant (SYR/0/020).
- Supporting Strategic Planning to Meet Future Energy Needs in ARASIA Member States (RAS/0/052),
- CRP (CRP12216) on: Safety significance of postulated initiating events for different research reactor types and assessment of analytical tools (J7.10.10);
- CRP (CRP15044) Innovative methods in research reactor analysis: Benchmark against experimental data on neutronics and thermal hydraulic computational methods and tools for operation and safety analysis of research reactors.
- Improving Utilization of Miniature Neutron Source Reactor (SYR/4/009)
- Energy and Nuclear Power Planning Study (SYR/0/006)

- Nuclear Safety (SYR/9/005)
- Research Reactor (SYR/4/002)
- Nuclear Analytical Laboratory (SYR/0/004)
- Uranium Exploration (SYR/3/002), (SYR/3/004)
- Uranium Recovery from Phosphoric Acid (SYR/3/003)
- Nuclear Electronics (SYR/4/003), Nuclear Electronics (Phase II) (SYR/4/005)
- Waste Management (SYR/9/004)
- Human Resource Development and Nuclear Technology Support (SYR/0/019)

2.9. HUMAN RESOURCES DEVELOPMENT

The Atomic Energy Commission of Syria (AECS) has strengthened education and training in radiation protection since early 90's.

In cooperation with IAEA, the AECS has established a Postgraduate Educational Course (PGEC) in Radiation Protection and the Safety of Radioactive sources that is still running since 2000. the language of instruction is Arabic and the syllabus are those of the IAEA. In 2006, AECS and the IAEA in collaboration with the University of Damascus have upgraded this PGEC into a Master Course. The course is now self dependent at the University. More than 240 Arab students (from 16 Arab countries in Asia and Africa) have graduated as Radiation Protection Officers, 71 of them are from Syria.

In collaboration with Damascus University, the AECS established at the Faculty of Mechanical Engineering the Nuclear Engineering Section. The section is teaching nuclear engineering at the undergraduate study level. The undergraduate program consists of 5 years. The first three years are devoted to basic study and the last two years for the specialization in the field of nuclear engineering.

The nuclear Engineering program comprises of 24 courses: 70 units for theory and 38 units for laboratory experiments and codes calculations. The last year includes a final study project related to running research activities at AECS. The selection of program courses rely upon the nuclear engineering courses of recognized university like, MIT, Berkley, University of Florida, University of Missouri, University of Maryland, University of Tennessee in the US and University of Karlsruhe in Germany. The main courses of the undergraduate program consist of:

Reactor Engineering, Reactor physics, Reactor Safety, Thermal Hydraulic Analysis, Fuel Cycle, Fuel Management, Waste Management, Radiation Protection, Reactor Shielding, Radiation Application, Reactor Dynamic, Energy System Analysis ….

MNSR reactor is used as a training tool to perform selected nuclear engineering experiments. MNSR provides also a unique opportunity for students to conduct experiments and get some skills;

AECS is also educating the personnel in the nuclear field in its research laboratories and has continuous training courses related to safety and radiation protection.

2.10. STAKEHOLDER COMMUNICATION

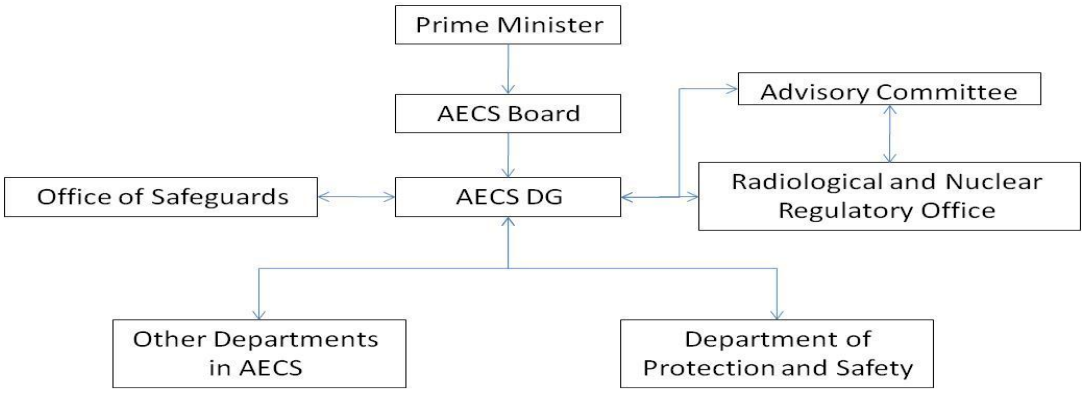
The communication shall be further coordinated in the framework of the ongoing IAEA national project SYR0020.

3. NATIONAL LAWS AND REGULATIONS

3.1. REGULATORY FRAMEWORK

3.1.1. REGULATORY AUTHORITY(S)

The following is a chart illustrating the Regulatory Authority:



The Presidential Decree No. 64 of 2005 was issued on 3.8.2005 by the president of the Syrian Arab Republic. This legislative decree complies with the international standards as specified in the BSS and GS-R-1, the commitments of the Syrian government in its letter to IAEA Director General regarding the application of the code of conduct and the Security Council decision No. 1541. It nominates AECS as:

- The regulatory authority in respect to radiation protection and safety and security of radiation sources.
- Responsible for emergency planning and coordination for radiological or nuclear accidents

- The competent authority responsible for issuing approval certificates for package design.

AECS is obliged by this legislative decree to establish a regulatory organ to carry out the duties assigned by this legislative decree and to appropriately staff it and provide resources needed.

AECS established the regulatory organ: the Radiological and Nuclear Regulatory Office (RNRO) by Decision No. 23/6 dated 10/10/2006.

By this legislative decree, AECS is empowered to:

- Prepare regulations, to be issued by the prime minister.
- Issue authorizations.
- Perform inspections. Inspectors have the powers of Judicial Police.
- Impose enforcement actions
- Undertake measures to detect illicit trafficking
- Verify the absence of contamination exceeding permissible limits in the goods imported to or crossing into Syria
- Promote protection, safety and security culture among the public.

Moreover, this legislative decree prescribes sanctions in case of non-compliances. The sanctions scheme takes into account the risk associated with the radiation sources. It also defines the civil liability for damages due to radiological or nuclear accidents.

By this legislative decree, an advisory committee, the “radiation protection and safety and security of radiation sources committee”, is established to support AECS.

3.1.2. LICENSING PROCESS

ALL REGULATORY FUNCTIONS ARE CONTROLLED BY THE PRIME MINISTER DECREE NO. 134 OF 17.1.2007 "GENERAL REGULATIONS ON RADIATION PROTECTION AND SAFETY AND SECURITY OF RADIATION SOURCES"

DETAILED REGULATIONS FOR THE SAFE TRANSPORT OF RADIOACTIVE MATERIALS, (DECISION NO. 813/2000) ARE BASED ON ST-1, 1996.

THE PROCESS FOR OBTAINING A LICENCE FROM THE REGULATORY AUTHORITY GOES AS FOLLOWS:

- Licensee submits an application form to the AEC-RNRO, containing all detailed data and information about the activity (responsibilities, radiation sources, location, workers, monitoring, emergency …..)
- For some activities, the form should be attached with radiation protection program
- The RNRO makes an assessment of the application and radiation protection program
- If the submitted documents are sufficient, the RNRO pays a visit to the site to inspect and check the availability of safety arrangements
- Only then a decision may be taken to issue an authorization. However, if there is lack of some information, data or safety arrangements, a letter shall be sent to the Licensee for further action.

3.2. MAIN NATIONAL LAWS AND REGULATIONS IN NUCLEAR POWER

CURRENTLY, THERE ARE NO SPECIFIC NATIONAL LAWS REGULATING NUCLEAR POWER IN THE SYRIAN ARAB REPUBLIC. HOWEVER, PRESIDENTIAL DECREE NO. 64 OF 2005 IS THE LAW THROUGH WHICH THE REGULATORY BODY IN SYRIA IS REGULATING AND SUPERVISING THE SYRIAN MNSR AND RELATED MATERIALS.

DURING THE NEXT TECHNICAL COOPERATION CYCLE, A NATIONAL TC PROJECT SHALL BE PROPOSED IN THE PURPOSE TO ASSIST THE COUNTRY IN ESTABLISHING THE NUCLEAR LAW.

Research Reactor: This research reactor is under International Atomic Energy Agency project and supply agreement. Regulatory supervision of the research reactor, which includes an inspection and reporting program, licensing of facility and operational staff, and mandatory regulatory documents, is in line with the guidance in the code of conduct on the safety of research reactors. This regulatory supervision is carried out by the RNRO of the AECS. The operation licence of the MNSR is renewed on a yearly basis. MNSR Staff licence is renewed every 2 years.

Articles 7 and 8 and appendices 1 and 2 of the instructions on licensing radiation practices, AECS Director General's Decision 623/2008, deal with the licensing of the import and the export of radiation sources, which are in compliance with the Supplementary Guidance on Import and Export Controls.

AECS is the only organization concerned with the radiation pubic exposure control in Syria. Department of protection and safety is the technical department for radiation protection and measurements. AECS laboratories have adequate equipment and can perform the required measurements for a comprehensive environmental monitoring

program. In addition, Article 61 (in the general regulations) prohibited the discharge of radioactive materials from authorized practices or radiation sources – including radioactive waste - into the environment unless it is within the limits stated by the authorization. It is the responsibility of the users to carry out an environmental monitoring through a program approved by RNRO.

Waste Management: Radioactive Waste Management Facility was established in co-operation between AECS and IAEA. AECS established a separate "Radioactive Waste Treatment Division (RWTD)", having full responsibilities of following up the situation of wastes generation in the country (collecting, storing and treatment). Chapter 14, in the general regulations, describes the national policy and clarifies strategy for waste management, and allocate responsibilities in which users are requested to minimize the amount of radioactive waste generated by their practices and required to re-export of all imported spent sealed sources back to the country of origin, and provide solutions for sources imported prior to its coming into force, like disposal of sources at the AECS waste disposal facility. This will be the core for future radioactive waste and spent fuel management, including storage and disposal.

Emergency Situations: AECS is the governmental body responsible by law for building competence for response to radiological or nuclear emergencies in Syria (legislative decree No. 64). RNRO is responsible for preparing, reviewing and supervising the national emergency plan (NEP) for radiological and nuclear emergencies. The NEP was written on the bases of threat assessment in Syria. Categories III, IV and V are recognized in the country. Categories I and II do not apply for Syria as there is no LPZ zones within Syria. National Emergency Plan for response to radiological and nuclear emergencies: finalized and issued under AECS decision No. 1427/2002 dated 20/11/2002. A detailed work plan to review and coordinate the On-site and Off-site Emergency Plans and to perform drills at different levels was established. The NEP nominated many governmental organizations as co-operating organizations. All co-operating organizations nominated in the plan contributed to it, and agreed to the roles allocated to each of them in the plan. Classification of accidents is stipulated in the Plan for categories III and IV.

For cat V, IAEA recommendations for intervention levels have been adopted. IAEA intervention levels and action levels for agricultural countermeasures were adopted and included in the national emergency plan. In addition, IAEA operational intervention levels (OILs) were also adopted in the plan. For the sake of the nuclear power reactor in Syria, NEP needs to be updated to include thread categories I and II and add more organizations to have responsibilities in the plan in accordance to IAEA guidance.

Organizational structure and competencies of the existing regulatory authority in the Syrian Arab Republic will have to be rearranged in order to be able to regulate nuclear power plants in accordance with international guidance and relevant IAEA safety standards.

Analyze of the operational needs and long-term needs for specialists is required, and recruitment and training plans need to be detailed in order to employ sufficient staff with

suitable qualifications and expertise along with the development of the nuclear power program.

In this respect, Syria is in the process of preparing national nuclear law in the line of the legislative requirements for the nuclear power program for electricity production. The Syrian competent authorities are also working to establish a follow-up structure for the nuclear power project according to the IAEA Nuclear Energy Series No. NG-G-3.1 (MILESTONES IN THE DEVELOPMENT OF A NATIONAL INFRASTRUCTURE FOR NUCLEAR POWER).

International and regional cooperation and exchange of regulatory information with the regulatory authorities of countries with advanced nuclear power programs and those with new ones need to be arranged. IAEA assistance is required for the standardization and harmonization of the approaches followed.

REFERENCES

[1] Atomic Energy Commission, http://www.aec.org.sy.

[2] Central Bureau of Statistics, http://www.cbssyr.org.

[3] Ministry of Electricity, http://www.moe.gov.sy.

[4] Public Establishment for the Generation and Transmission of Electricity, http://www.peegt.gov.sy.

[5] National Energy Research Centre, http://www.nerc-syria.org.

[6] Ministry of Petroleum and Mineral Resources, http://www.petroleum.gov.sy.

APPENDIX 1

INTERNATIONAL, MULTILATERAL AND BILATERAL AGREEMENTS

- **Agreements with The International Atomic Energy Agency**

Abb.	Title	In Force	Status
P&I	Agreement on the Privileges and Immunities of the IAEA	1989	Party
VC	Vienna Convention on Civil Liability for Nuclear		Non-Party

	Damage		
CPPNM	Convention on the Physical Protection of Nuclear Material		Non-Party
CPPNM-AM	Amendment to the Convention on the Physical Protection of Nuclear Material		Non-Party
ENC	Convention on Early Notification of a Nuclear Accident	1987	Signatory
AC	Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency	1987	Signatory
JP	Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention		Non-Party
NS	Convention on Nuclear Safety	1994	Signatory
RADW	Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management		Non-Party
PAVC	Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage		Non-Party
SUPP	Convention on Supplementary Compensation for Nuclear Damage		Non-Party
RSA	Revised Supplementary Agreement Concerning the Provision of Technical Assistance by the IAEA (RSA)	1981	Signatory

- **Safeguards Agreements**

- Nuclear Non- Proliferation Treaty – Party 1969.

- Agreement between the Government of the Syrian Arab Republic and the IAEA for the Application of Safeguards in connection with the NPT, 1992.

- Syria has expressed support for the Code of Conduct on the Safety and Security of Radioactive Sources

- **Cooperation Agreements with IAEA in the area of Nuclear Power**

- Project and Supply Agreement between the Government of the International Atomic Energy Agency and the Governments of the Syrian Arab Republic and the People's Republic of China concerning the Transfer of a Miniature Neutron Source Reactor and Enriched Uranium, 28 February 1992.

- Co-operative Agreement for Arab States in Asia for Research, Development and Training Related to Nuclear Science and Technology (ARASIA), 2002.

- **Bilateral Agreements with other Countries or Organizations signed/ratified by the Syrian Arab Republic in the field of Nuclear Power**

- Agreement between The Government of Russian Federation and The Government of Syria for Cooperation in the Peaceful Uses of Nuclear Energy, 1999

- Agreement between The Government of India and The Government of Syria for Cooperation in the Peaceful Uses of Nuclear Energy, 1980

- In addition to Scientific and Technical Agreements with other Governments such as Egypt, Lebanon, Pakistan, Argentina, Japan, Turkey, China, Belarus, …etc.

- Syrian Arab Republic is one of the founding Member States of the Arab Atomic Energy Agency (AAEA), 1966

- Syrian Arab Republic has scientific and technical co-operational relations with regional and international organization such as ICTP, TWAS, COMSATS.. etc.

APPENDIX 2

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

NATIONAL NUCLEAR ENERGY AUTHORITY

The Atomic Energy Commission of Syria	17 Nissan Street- Kafer souseh P. O. Box 6091, Damascus – Syria Telephone number: +963-11-2132580 Facsimile number: +963-11-6112289 E-mail address: atomic@aec.org.sy Web site address: www.aec.org.sy

OTHER ORGANIZATIONS

Ministry of Electricity	17 Nissan Street- Kafer souseh Opposite to Carlton Hotel Damascus- Syria Telephone Number:+963-11-2133972 Facsimile number: +963-11-2229062 E-mail address: moe@net.sy Web site address: www.moe.gov.sy
Public Establishment for the Generation and Transmission of Electricity	17 Nissan Street- Kafer souseh Opposite to Carlton Hotel Damascus- Syria Telephone number: +963-11- 2229062 / 2129981 Facsimile number: +963-11-2127732 E-mail address: peegt@net.sy, peegt@gov.sy Web site address: http://www.peegt.gov.sy

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Director General

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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