

SYRIAN ARAB REPUBLIC
MINISTRY OF ELECTRICITY
**SUPPLY SIDE EFFICIENCY & ENERGY CONSERVATION &
PLANNING PROJECT**



***Identification of National Energy Policies and
Energy Access in SYRIA***

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Abstract

This report provides an overview of the energy scene in Syria and the various policies that the Syrian Government is undertaking to meet the challenge of steadily increasing energy consumption in the country. The main energy sources used are Oil Products, Natural Gas, Electricity, and Renewable (mainly hydro-electricity and wood fuel). The economic situation in Syria has been mildly improving with the fact that all fuel resources consumed in Syria are domestic providing a positive bearing on the economy of the country. The electricity tariff for the residential sector is still fairly well subsidized but is now moving in a new trend towards making electricity users, especially the large users and the productive sectors to pay, more or less, the real price of electricity production. The percent of population below the lower level of poverty is still relatively high at 11.4 % of total population, based on the Syrian poverty line of about 44 SP/day per capita (i.e., one dollar per day). Poor people live primarily in rural areas and are less educated, with 81.3 % of them at the elementary education level or lower with a larger family size. To reduce cost and burden on the economy as a whole, on the supply side, the electricity sector in Syria will concentrate on the rehabilitation of old generating units and to convert existing single gas turbine units to combined cycle units. As Syria has a large reserve in natural gas it is expected to increase the dependency of electricity generation on this fuel. Furthermore, because Syria is endowed with a large renewable energy resource, it is also expected to increase the dependency on renewable energies (solar, wind, biomass) and to improve and enhance power systems interconnections with Arabic countries and Turkey. The real challenge that will be faced at this stage is which strategy has to be adopted when changing from direct subsidy to targeted subsidy without deteriorating the living of economically vulnerable social classes and low income people. Renewable energy resources will have to be developed against barriers primarily due to the absence of an effective organization which act as a driving force, a heavily subsidized conventional energy sector, and a predominant public sector renewable energy industry, with no particular incentives to respond to market driven economic signals. This is being addressed by the new the National Energy Research Center (NERC), created in mid 2003 through the preparation of an energy policy project and the establishment of regulations regarding energy and environment. Possible policy instruments are to give low interest loans to purchase efficient appliances and the reduction of taxes and the charge dues. NERC is now preparing a National Renewable Energy Master Plan (REMP) with an implementation period extending over a period of 10 years, from 2002 to 2011.

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1. Physical and Climate Features

The Syrian Arab Republic lies on the eastern coast of the Mediterranean Sea, bounded by Turkey to the north, Iraq to the east, Palestine and Jordan from the south and by Lebanon and The Mediterranean Sea to the west. The total area of SAR is 18517971 hectares of which 6 million hectares are cultivated land and the remainder is desert and rocky mountains. The Syrian desert is suitable for grass growing and is used as pastures when there is a sufficient rainfall.

The climate of the Mediterranean Sea generally prevails in Syria, this climate may be characterized by rainy winter and a dry hot summer separated by two short transitional seasons. The coastal region is characterized by heavy rainfall in Winter and moderate temperature and high relative humidity in Summer. The interior is characterized by a rainy Winter season and a hot dry season during Summer, The area in the mountains with an altitude of 1000 meters or more characterized by rainy Winter where rainfall may exceed 1000 mm and moderate climate in Summer.

2. Economic Situation

The GDP at constant 2000 prices and the share of the various sectors of this GDP are shown in Table 1 below. The Syrian population was about 17.980 Million in mid 2004, of which 9.022 Million was considered as "urban." According to the population census, the average annual growth rate was 2.45% during the nineteenth of 20th century. As shown in Table 1, the GDP at constant 2000 prices has risen from about SP 904 Billion in 2000 to about SP 1004 Billion in 2003, which represents an average annual increase of about 3.6%.

Table 1: GDP Share at Constant 2000 Prices

Years	2000	2001	2002	2003
GDP (Billion SP)	903.9	938.6	978.4	1004.3
Population (thousand)	16320	16720	17130	17550
GDP per capita (SP per year)	55386	56136	57116	57225
GDP distributed as follows:				
Agriculture (%)	25	26	27	26
Mining & Manufacturing (%)	30	30	28	27
Building & construction (%)	3	3	3	3
Wholesale & retail trade (%)	15	15	15	15
Transport & communication (%)	13	13	13	13
Finance & insurance (%)	4	3	3	3
Social & Personal services (%)	2	2	3	3
Government services (%)	8	8	8	10
Total (%)	100	100	100	100

Source: Central Bureau of Statistics

2.2 General Poverty Profile Data

The State Planning Commission summarized a new survey results in a local news paper that a survey was carried out recently on about 30 000 families in different parts in Syria by three bodies (Central Bureau of Statistics, State Planning Commission, and UNDP office in Damascus) concluded the following:

- The percent of population below the lower level of poverty is 11.4 % of total population (20,020,000 person), on the basis that the Syrian poverty line is some

what about 44 SP/day per capita (i.e., 1454 SP per month), that is less than one dollar per day. This figure is based on the expenditure per capita, rather than the income per capita. The poverty in Syria is specified by upper and lower level. 19% of Syria population (3.2 Million) is classified between these 2 levels.

- The annual cost for the state to improve the living of the population classified below poverty level above this level is SP 600 Million. (USD11.5 Million).
- Poverty is mostly based in the rural areas of Aleppo, Raqqa, Deir Al-Zour and Al-Hassakeh, and most of them work in agriculture and have no land properties.
- The majority of the poor people are the less educated, 81.3 % of them are elementary or less educated. The income of the people classified as poor is either low or they work on seasonal or temporary jobs. The aggravation of poverty is also due to the price inflation.
- The size of family is bigger among the poor classes, the average number of infants in 3.25 in a poor family and 1.9 in other families.
- Poverty Percentage is almost stable since 1994 in the same areas.

3. General Energy Profile:

3.2 Security of Energy Supply:

Syrian energy policy takes into consideration the following priorities:

- To expand the gas market.
- To sustain the oil production.
- To develop the country's power capacity.
- To promote the energy efficiency and the use of renewable energy resources.

The production of electricity reached 32 TWh in 2004 with an installed capacity of almost 7 GW. With Syrian electric power demand growing rapidly, adding electricity supply capacity is an important national priority.

3.3 Energy Balance in Syria

The total energy consumption in Syria in millions of tones of oil equivalent (TOE) is shown in Table 2. In addition to the amounts shown in the table, traditional biomass energy resource consumption values of wood-fuel is estimated at about 0.6 to 0.7 millions of TOE annually. Energy demand has increased from 12.6 MTOE in 1995 to about 16.5 MTOE in 2005, which represents an average annual increase of about 4.5%. The main energy sources used are Oil Products, Natural Gas, Electricity, and Renewable (mainly hydro-electricity and wood fuel). All fuel resources consumed in Syria are domestic, however, there is small amount of imported oil products, which are used mainly in the residential and commercial sectors.

Table 2: Energy Consumption in Syria (Million TOE)*

Years	1995	1996	1997	1998	1999	2000	2001
Oil products	8.88	8.63	9.25	9.67	10.16	11.13	11.30
Natural gas	2.52	2.99	3.51	3.84	3.94	3.83	4.11
Hydro-electricity	0.700	0.887	0.884	0.870	0.526	0.626	0.530
Total Energy Demand	12.10	12.51	13.64	14.38	14.63	15.58	15.94

The distribution of primary energy demand in Syria by Fuel and sectors for 2003 are as follows:

By Fuel	18588 ktoe	By Sector	100%
Oil Products	12311 =	Industry	10%
Natural Gas	4877 =	Residential	18%
Hydro-Electricity	700 =	Electricity Generation	38%
Wood-Fuel	700 =	Oil & Gas Facilities	6%
		Agriculture	5%
		Transport	18%
		Construction & Commercial	4%

4. General Electricity Profile:

4.1 Electric Demand Analysis

The gross electric energy and peak demand in Syria is shown in Table 3. Electric energy demand has increased at an average rate of 5.58%. Over the next 15 years it is expected to increase at an average rate of 4.9% in the reference scenario but may vary between 3.9% in the low scenario to about 4.9% in the high demand scenario.

Table 3: Gross Electric Energy and Peak Demands in Syria

	Gross Electricity Demand			Peak Demand		
	GWh			MW		
Year	Reference Scenario	High Scenario	Low Scenario	Reference Scenario	High Scenario	Low Scenario
2001	26712			4565		
2002	28012			4791		
2003	29533			5081		
2004	31860			5770		
2005	33190	33430	32957	5749	5806	5695
2010	43441	46677	41518	7523	8202	7078
2015	53874	60642	49305	9318	10749	8275
2020	65207	75386	56983	11278	13468	9482
2025	76573	90233	64632	13244	16221	10693
2030	87941	104916	71736	15210	18861	11868
2034	98559	118639	78170	17047	21328	12933

4.2 Installed Capacity

The current installed capacity in the Syrian system is about 7019 MW with 51.9% made up of steam turbines, 22.2% combustion turbines, 8.5% combined cycle, and 17.2 % hydro-electric turbines. About 300 MW of combustion turbines are being converted to combined cycle, in addition to 800 MW of new CC power under construction.

4.3 Electricity Tariff

The electricity tariff effective since 1/6/2002 in Syrian Piastres per kWh (p/ kWh) is given in Table 4. The new tariff structure has been put in place to discourage the use of electricity by the commercial and industrial sectors during peak hours. The tariff for the residential sector is based on

a stratified tariff with a life line rate of 25 p/ kWh, which is the equivalent of about 0.5 US c/ kWh. The tariff for monthly consumption above 300 kWh is 250 p/ kWh up from 75p/ kWh, which was the practice from 1991 to 2002, as shown in Table 5.

The electricity tariff variation over the years 1998 to 2005 is shown in Table 5. Despite the fact that electricity is still fairly cheap in Syria, the change indicates a new trend towards making electricity users, especially the large users and the productive sectors to pay more or less the real price of electricity production.

Table 4: Effective Tariff since June 1, 2002

Item	Consumption Voltage Level	Peak	Day	Night	Average
1-	230 kV	215	170	150	170
2-	66 kV	225	180	160	180
3-	20 kV	235	200	170	200
4-	20/0.4 kV				
4-1-	Industrial	325	240	200	240
4-2-	Commercial	325	240	200	240
4-3-	Agriculture (all crops)	225	180	160	180
5-	0.4 KV				
5-1-	Residential				
	1-50 kWh/ month				25
	51-100 kWh/ month				35
	101-200 kWh/ month				50
	201-300 kWh/ month				75
	301 and above kWh/ month				250
5-2-	Commercial & Small Workshops				250
5-3-	Government Offices				200
5-4-	Street Lighting				150
5-5-	Religious Buildings				Free of Charge

Taxes collected for other Ministries

* NOTE 1 : / 10% / of 0.4 kV sales for Ministry of Local Administration & Environment.

** Note 2 : / 12.5% / of Total Electricity Sales for Ministry of Finance

*** Note 3 : / 50 SP / . Electric Meter Charge per cycle per Single Phase Meter.

**** Note 4 : / 150 SP / . Electric Meter Charge per cycle per Three Phase Meter.

***** Cycle = two months. Peak starts from sunset for 4 hours

Night starts from end of peak for 8 hours, the rest is day time

Power Factor correction (Penalty & Bonus) :

$(0.9-0.93) = (0.9/ \text{Customer PF})-1$ (penalty tariff)

More than 0.93 = $(\text{Customer PF}/ 0.93)-1$ (bonus tariff)

Table 5
Electricity Tariffs Effective 1988 - 2005 (S.Piaster/KWh)

Item	Consumption Voltage Level	From 1988 to 1990	From 1991 to 31/5/2002	From 1/6/2002
1-	230 KV	34	75	170
2-	66 KV	36	80	180
3-	20 KV	42	90	200
4-	20/0.4 KV			
4-1-	Industrial	43	120	240
4-2-	Commercial	43	125	240
4-3-	Agriculture (all crops)	25	80	180
5-	0.4 KV			
5-1-	Residential			
	1-50 kWh/month	19	25	25
	51-100 kWh/month	24	35	35
	101-200 kWh/month	35	50	50
	201-300 kWh/month	35	75	75
	301-400 kWh/month	55	150	250
	400 and above kWh/month	75	150	250
5-2-	Commercial	75	150	250
5-3-	Small Scale Artisan	75	140	250
5-4-	Street Lighting	15	75	150
5-5-	Government Offices			
	1-50 kWh/month	19	75	200
	51-100 kWh/month	24	75	200
	101and above kWh/month	35	75	200
5-6-	Religious Buildings	Free of Charge		

4.4 Key Indicators in the Electricity Sector

The key indicators in the electricity sector for the years 2000 to 2005 is shown in Table 6. Clearly the apparent effort is in expanding the 400kV manifested in the increase of line length from 678 in 2000 to 738 in 2005 and in strengthening the connection between the 230 kV and 400 kV transmission systems. The number of 20/0.4 kV distribution substation has increased from 33946 to 43946, which allowed a consequential increase in the number of people having access to the grid from 97% to over 99%.

Table 6
Main key figures of 9th five years plan for Syrian Power System

Lable		Unit	2000	2001	2002	2003	2004
Total installed capacity	Installed	MW	6699	6804	7014	7014	7014
	available		6145	6250	6450	6450	6450
Steam tubine	Installed	MW	3636	3636	3701	3701	3701
	available		3050	3355	3355	3355	3355
Gas turbine	Installed	MW	1160	1160	1160	1160	1160
	available		1140	1140	1140	1140	1140
Hydro turbine	Installed	MW	1213	1318	1528	1528	1528
	available		962	1170	1380	1380	1380
Combined cycle	Installed	MW	600	600	600	600	600
	available		600	600	600	600	600
Diesel oil	Installed	MW	394	394	394	394	394
	available		90	90	90	90	90
Substations 400/230 kV		No. / MVA	6/2700	6/2700	6/3000	6/3600	6/3600
Substations 230/66/20 kV		No. / MVA	43/6430	44/6880	47/7935	48/8765	49/9030
Substations 66/20 kV		No. / MVA	169/6482	170/6662	173/7136	203/8616	218/8966
Substations 20/0.4 kV		No.	33946	35384	38343	41157	43442
Length of transmisson lines 400 kV		km	678	678	738	738	738
Length of transmisson lines 230 kV		km	4421	4518	4756	4984	5000
Length of transmisson lines 66 kV		km	5496	5599	5881	6281	6736
Length of transmisson lines 20 kV		km	48089	50821	52725	55046	57374
Length of transmisson lines 0.4 kV		km	70989	71542	74968	79263	82292
Number of consumers		Consumers	3184808	3332934	3494825	3680000	3893000
Number of electrified villages		No.	10434	10774	11042	11766	12122
Percentage of pepole with access to grid		%	97%	98%	98%	99%	99%
Number of employees at electricity sector		No .	30900	32084	34389	35375	36000
Total electricity gross generation by Fuel Type :			25227	26715	28014	29533	31890
Hydro		Gwh	2503	2119	2501	2804	4247
Gas		Gwh	11224	11915	15015	15579	14062
Fuel oil		Gwh	11489	12677	10396	11148	13579
Diesel		Gwh	7.8	1.9	102	1.4	1.8
Wind turbine		Gwh	3.09	1.71	0.16	0.29	0.2
Total electricity gross generation by sources :			25227	26715	28014	29533	31889
Ministry of electricity		Gwh	21493	23428	24450	25548	26769
Ministry of Petroleum		Gwh	1233	1171	1067	1224	896
Ministry of irrigation		Gwh	2501	2116	2497	2761	4224
Annual peak demand		MW	4128	4565	4791	5081	5770
Date of annual peak			23 Dec.	24 Dec.	16 Dec.	24 Dec.	20 Dec.
Annual load factor		%	70%	67%	67%	66%	63%

4.5 Electricity Consumption in the Residential Sector:

The total electricity generation grew from 25227 GWh in 2000 to 31889 GWh in 2004, as shown in Table 7 above, at an average rate of about 6%. The electric energy consumption in the residential sector is shown in Table 7 below and represents about 32% of the gross electric energy generation.

Table 7: Electricity Consumption in the residential Sector

Years		2000	2001	2002	2003
Estimated Residential Consumption	GWh	8032	8451	9165	9936

4.6 Statistical Survey of Non Electrified Communities in Homs, Hamah and Al-hassakeh

During 2003-2004 Ministry of Electricity in cooperation with central bureau of statistics and UNDP office in Damascus. implemented a survey about energy consumption in the non electrified communities in three Governorates, Homs, Hama, Al-hassakeh as an essential approach in order to launch overall survey in all Syrian remote areas.

4.6.1 Results analysis:

Since it was discovered, Electricity has been considered a key factor for development in all fields of life, and in Syria this is no exception where the electric system has to be expanded in order to meet the increasing demand. International research shows that it is not economically feasible to connect remote area to the main grid, especially in the case of scattered small villages.

The development of renewable energy especially solar, wind, and biomass energy, gives an economic solution to electrify remote areas. In Syria renewable energy has been used in different fields, such as wind mill in the past Al-Qalamon region), and in the form of hydroelectric and biomass residues in the present. No doubt that renewable energy, basically of wind, solar and biomass energy, could essentially contribute to the national energy balance; and the Master Plan of renewable energy in Syria which has been prepared and published by the Ministry of Electricity financed by UNDP, has enhanced our understanding of the current situation and future possibility for the renewable energy in the S.A.R .

As a continuation of the Master plan and for the purpose of rural area developing, a survey was executed in cooperation with the Central Bureau of Statistics and financed by UNDP. The survey shows the energy use in remote non electrified area in three Governorates, Homs, Hama, and Al-Hassakeh, which forms is an essential basis by which the approach will be developed in order to launch overall survey in the whole country, and hereunder a brief summary of survey's result is presented.

General Data about Communities

- The results show some unoccupied communities though they are mentioned in the administration division and in the schedules of the electricity distribution company as non electrified communities. The number of the unoccupied communities is 14 while the total number of communities is 510 in the three Governorates.
- 28% of studied communities are less than 1000 meters far from the nearest electrified communities, so they are candidates for detailed study to connect them to the main grid, while 72% of these communities are more than 1000 meters far away, and this means trying to find other sources of energy than the main grid.
- Usually these communities obtain drinking water by one of two ways, either from nearby water wells; wells not far more than 1 km counted 196 well, or by tankers from distant sources. Total number of wells is 245, 64 of them owned by the state and the rest by residents of communities, noting that depth of water in 83 wells was no more than 100 meters, which gives a good possibility to use pumps operated by PV cells.
- Total number of families in the studied communities is 5036 families. 210 families live

seasonally in the communities. The population in the communities was 43181 persons; Average size of family is 8.6 person per family.

- Total number of houses is 5759 including tents. 1781 houses are built by bricks and cement, the rest are built by stone, wood and mud. Occupied houses are 4752 and 98.76% of which are heated.

Energy Resources and Uses within Communities:

- The results show considerable quantities of consumed oil products for the purpose of lighting, cooking, water and space heating; which indicates inefficient use of these sources. The number of small and medium size batteries used annually is 1031203, analyzing these data will help the feasibility studies for energy substitution studies. As well as people of communities used 4770 of chemical batteries (car batteries) to operate TVs.
- Total annual amount of consumed DO by these communities is 5719 000 liters, 1135 liters per family per year, knowing that average amount for rural family in electrified communities according to previous survey is 771 liters per family per year. 60.87% of the total amount is used for space heating, 23.38% is used for lighting, 0.45% is used for water heating and 15.3% is used to operate cars or tractors. Average price of DO is (7.5) S.P per liter.
- Total annual amount of consumed LPG 134030 Bottles, 1608 tons, and the average is 26.6 bottles per family per year, - knowing that the average in the previous survey for electrified rural area was 17.9 Bottles per family per year - 18.32% of total amount used for lighting, 81.62% is used for cooking and water heating, 0.06% is used for space heating. The cost of LPG bottle is 175 S.P.
- Total amount of kerosene consumed annually within the communities is 601000 liters, the average is 119.6 liter per family per year, knowing that the average in the previous mentioned survey was 40 liter per family per year in the electrified communities, 55.88% of total amount is used for lighting, 44.4% is used for cooking and water heating, 0.08% is used for space heating. The cost of kerosene is 21 S.P per liter.
- Total annual amount of animal residue is 2011 tons, 2.84% of the total amount is used for space heating, and 97.16% is used for cooking and water heating. Knowing that a lot of animal residue is not collected and left in the ground, there is a possibility to use this amount of residues to produce biogas as an alternative for LPG.
- Total annual amount of agricultural residues is 8641 tons, including 3544 tons of purchased wood which cost between 1000 and 3000 S.P. per ton, 8.74% is used for space heating and the rest for cooking and water heating. When asking people how they get rid of the crops residue, 50.98% answered they use it to feed animals, 18.96% answered they just leave it on the ground or burn it, so this indicates that there is a possibility to obtain biogas from these residues.

Facilities Available in the Communities

The results show that there are about 34 schools within the communities and 3 veterinary clinics located in Homs desert, besides 6 small commercial shops. The annual number of small and medium size batteries was 929 batteries, and the annual amount of consumed light oil was 44600 liters, 83.74% used for space heating, and the rest for lighting. Total annual amount of consumed LPG was 134000 Bottles, 1608 tons, 34.39% used for lighting, 57.47% for cooking and water heating, the rest for space heating. While total annual amount of kerosene consumed

was 605 000 liters, 73.68% for lighting, the rest for cooking and water heating, there was no notice for any use of biomass residue within the facilities.

Conclusion:

Total amount of fossil fuel (DO, kerosene and LPG) consumed is about 6800 tons, the average is 1358 Kg. per family, and this costs every family about 15000 SP based on local prices and 450 \$ according to the international prices. The total number of consumed small and medium batteries was more than one million batteries, this means that the average is 200 batteries for each family, as well as every family uses at least one liquid battery, and this increases the lighting cost with about 2000 SP. So it is very feasible to find alternative source of energy for those poor families who spend a big portion of their income to get poor lighting.

Total annual amount of kerosene and LPG which is used for cooking is about 2110 tons, average of 419 kg per family. This means that encouraging the use of solar cooker will help to improve the living conditions of these families.

4.7 Future Electricity Sector in Syria

The electricity sector in Syria should concentrate on the following points:

- Rehabilitation of old generating units.
- Convert existing single gas turbine to combined cycle.
- Expansion in dependency on natural gas.
- Decrease total electrical losses in Syrian power system.
- Improve billing and electric metering system in distribution networks.
- Decrease specific consumption of HFO and NG down to 200 goe/kWh in power plants, through economic operation of existing PP.
- Improve technical qualifications of working manpower in ministry of electricity.
- Improve power system's load factor by applying DSM procedures.
- Construct pumping storage hydro-electric power plant on Euphrates river.
- Provide all existing power plants with EMS and MMS.
- Expansion in dependency on renewable energies (solar, wind, biomass)
- Improve and enhance power systems interconnections with Arabic countries and Turkey.

4.8 Main Demand Side Projects

The Syrian Government is firmly committed to the environmentally sustainable development of the energy sector. The Supply-Side and Energy Conservation and Planning Project (SSECP), financed by UNDP, GEF, OPEC Fund, have been in operation for five years and will be completed in 2005. The primary objectives of the "Syrian Energy Conservation and Planning Project" is to improve demand-side energy through the creation of a multi-purpose Syrian Energy Services Center (SECS) and a National Energy Efficiency Program (NEEP). The activities of the project focus on the greatest opportunities for improving electrical energy efficiency , reducing growth rate of electric power demand and reduction of greenhouse gases emission from industrial and other use. The work includes also the strengthening of institutional capacity of the Ministry of Electricity to implement and sustain long-term, sound energy measures that have a measurable, documented impact on the economic, environmental and social well being of the Syrian people. In a fast-changing economy, there are new measures through which these types of activities can be profitable and therefore leads to new job opportunities creation while assuring improved efficiency and affordable energy resources to the people of Syria.

The main activities of the SSEECF project are:

- Conduct preliminary (walk throw) energy audit studies for 200 industrial, commercial, and services facilities in Syria.
- Conduct 50 detailed energy audit studies from the above-mentioned facilities.
- Conduct 20 feasibility studies from the above-mentioned facilities, in order to find financing to implement recommendations and improvements of energy audits in 10 industrial, commercial, and services facilities in Syria.
- A full demand side management assessment of energy/electricity use in Syria, design a DSM pilot project
- Launch and design an energy efficiency and standards program and their adoption initiated, for residential electric appliances (refrigerators, washing machines, air conditions).
- Launch and initiation of The National Energy Efficiency Program, designee and analyze energy policy initiatives.
- Launch a cross sector information dissemination and promotion program for energy efficiency (issue brochures, TV and newspapers advertisements, Hotline...)

4.9 Main barriers

The main barriers that hinder improvements are:

- Subsidy of electricity and oil prices.
- Electricity tariff structure.
- Unavailability of new modern electricity consumption metering systems for consumers in residential, industrial, commercial and services sector.
- Availability of low efficient appliances in the market with cheap prices, compared with efficient appliances.
- Unavailability of energy efficiency legislation.
- Unavailability of private-public partnership (PPP) in energy sector.
- Unavailability of energy services conservation companies ESCOS.
- Lack of awareness concerning benefits of energy efficiency measures.
- Lack of statistics and data base on energy consumption by sectors, by end-use, and on renewable energy sources (biomass, solar, and wind).

4.10 Improvement in Energy Conservation and REC

The actions to improve situation of energy conservation and REC in Syria include the following:

- Creation of the National Energy Research Center (mid of 2003) which has been recently established in order to supervise the energy efficiency improvements studies and facilitate the renewable energy usage in Syria.
- The preparation of an energy policy project and the establishment of regulations regarding energy and environment, which comprise of the following:
 - Obligations of large energy users towards efficient use of energy and tapping the available Renewable Energy.
 - Obligations of major energy equipment manufacturers and distributors towards equipment efficiency.
 - Obligations of building designers, developers and operators towards the adoption of Energy Efficiency and Renewable Energy in new and retrofitted buildings.

- Obligations of large energy users and power suppliers towards energy conversion and use of Renewable Energy including Combined Heat and Power generation.
- Role of local Energy Service Companies (ESCOs).
- Government incentives for stimulating the Energy Efficiency and Renewable Energy market in the country.
- Creation and operation of a Green Fund Account.
- Procedures for the EE and RE Regulation enforcement.

4.11 Policy Instruments to Improve EE and RE Situations

- Giving long term loans to purchase efficient appliances.
- Giving non interest loans to purchase efficient appliances.
- Reducing taxes and the charge dues.
- Repaying rate of costs.
- Selling energy efficient appliances by soft installment plan.
- Securing suitable financing and funds, for private individual engineering offices (ESCOs core) to purchase energy audits equipment (power analyzers, flue gas analyzers, non-contact stroboscopic tachometer, light meter.....).

5. Renewable Energy Sources (RES)

The hydro energy is a significant factor in the electricity generation system. There are three large hydroelectric power stations in operation on the Euphrates River. In 2003 the installed capacity of hydro plants was 1.528 GW. The installed capacity of hydro plants is going to increase by 0.88 GW in the decade 2010-20.

Ministry of electricity in cooperation with UN DESA in the year 2002 has lunched a master plan for development of the usage of RES. The RES Master Plan presented, delineates sub-plans to be carried out for giving a major thrust to renewable energy development in Syria. Recommended programme initiatives are outlined including specific plans to be taken up for mainstreaming renewable energy in the national energy balance. Research, Development and Demonstration projects for technology development, Pilot projects for technology demonstration as well as investment-worthy projects covering different forms of renewable energy on the basis of existing data have also been identified based on national level consultations and the extensive analytical work

The National Renewable Energy Master Plan (REMP) consists of a set of actionable recommendations and proposals for renewable energy systems development along with the accompanying measures to facilitate this energy development. The master plan proposals have been formulated assuming that,

- The implementation period of the master plan will extend over a period of 10 years, from 2002 to 2011;
- The development of energy systems contributes to meeting the primary energy demand in the country. By progressively increasing the contribution of renewable energy in the total energy mix through planned efforts, the country would be able to reduce the burden of dependence on hydrocarbon sources such as gas based electricity, gasoline generators, diesel heaters and butane lamps;
- The accompanying measures such as the establishment of institutions, conducting studies and surveys and training and capacity building efforts would be put in place in order to facilitate implementation of the proposed plan.

- Government commitment to the master plan will result in an adequate resource allocation and establishment of Institutional Framework.
- In 2011 the final year of the master plan the contribution by renewable energy technologies is estimated at 1012 ktoe, which will represent 4.31% of the primary energy demand. The share of different renewable energy technologies is shown in Figure 1.

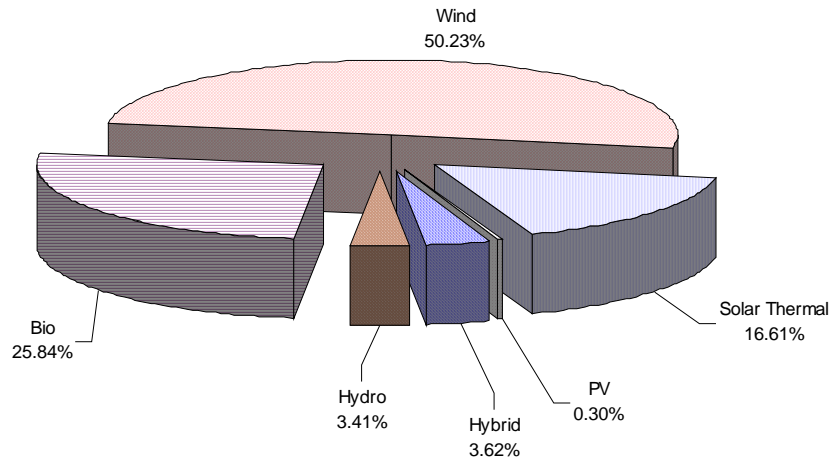


Figure 1: Share of Renewable Energy Contribution

5.1 Legal Framework/ Regulation

- Permits are required for the establishments for corporate entities
- The NERC approvals for establishment of projects or ventures and determines share of state capital in any project
- Feasibility studies are assigned to evaluate economic feasibility of important development projects.
- Any joint project where public sector equity is less than 25% may be registered as a corporation or a limited liability company
- Foreign currency deposits, plan, equipment and materials' import, profits and revenue to increase project capital and intangible assets from patents, trade marks are all considered as foreign capital.
- The value of fixed assets imported from abroad to support any such project should not be less than 200 000 USD.
- Joint companies may operate foreign currency account with interest accruals in Syria for project capital and foreign earning.
- Local currency borrowing may be secured against foreign currency deposits or account in Syria.
- Foreign or non resident investors may repatriate, after a lapse of 5 years the net value of their share not exceeding the amount of the initial foreign investment. Special provision exists also for early repatriation under certain conditions.
- Any joint project request submitted for approval shall be evaluated and council decision shall occur within 60 days of submission of such a request.
- Penalties are imposed for non-compliance of joint venture companies to accounting procedure or appropriate use of resources or imported equipment.
- Foreign personnel employed in joint projects are entitled to a repatriate of 50% of their total income in foreign currency.

5.2 Ongoing Initiatives for RET Introduction

Now in Syria we are going on assessment of wind and solar energy resources with cooperation with European Commission, and also we are planning to establish the first wind farm with 5 MW power in the Middle of Syria which is a cooperation effort between UNDP, JICA and Syrian government to introduce photo voltaic systems. The Romanian institute has done a detailed survey for small hydro power station potential in coastal area in the 1980s.

5.3 Assessment of Barriers to RET in Syria:

Barriers, which have been largely responsible for the relatively limited development and acceptance of renewable energy programmes, in particular pilot and commercial applications, in Syria may be grouped into:

- Absence of an effective organization which act as a driving force with clear responsibilities to develop policy, legislation and regulatory evolution within the government in Syria.
- A heavily subsidized conventional energy sector, with no special incentives in place to promote renewable energy investments.
- A predominant public sector renewable energy industry, with no particular incentives to respond to market driven demand on one hand and a nascent emerging private sector industry, being heavily constrained by regulatory restrictions.
- Lack of favorable import duties for renewable energy products and components and well as conducive policies to promote energy renewable energy developments.
- Unavailability of financial mechanisms and instruments encouraging energy renewable manufacture or use either through Government banks or private lending organizations to provide credit to consumer, especially rural applications, or even start-up manufacturing venture;
- Limited infrastructure or government support to create awareness of renewable energy potential or opportunities.
- Limited scope for R&D institutions to interface with international bodies and to share expertise already existed within the sector.
- Inadequate assistance from ODA funded programmes and a very cautious investments approach, which has further retarded the development of the demonstration and pilot projects.
- Syria does not have the availability of a fully skilled and experienced human resources base to support the integration, service and operation of such technologies and does not have a readymade training infrastructure to rapidly develop these resources.

Nowadays the government adopted such a pilot project which aimed to give the citizens a loans to install 10000 solar heating systems in residential sector. The renewable energy requirements restricts in developing the human resources experience and the aspect of training and implementing the pilot projects leading to renewable energy power plants.

6. Electricity Sector Reforms

Two main operating entities operate under the Ministry of Electricity: PEEGT (generation and transmission) and PEDEEE (distribution and exploitation). The two entities have limited autonomy on operational decisions. Regulation is carried out through the Ministry and there is as yet no

legislative provision for a separate regulatory agency. Nor is there legislative provision for the introduction of market mechanisms beyond an indication of the contractual arrangements that should govern any future IPPs. Within PEEGT and PEDEEE there are individual generating and distribution companies, but they have little control of their operations. These subsidiary operating companies could in principle form the basis of an unbundled industry, but transmission would need to be placed in a separate company from generation. There are still extensive subsidies to electricity prices for all classes of consumers, although recently the level of subsidy was much reduced. There is no competition law, policy or agency because most economic activity is under state control.

Syria has the third largest proven reserves of natural gas in the MEDA region, estimated at 240 bcm in 2001. It is expecting to double production in the next 5 years. The intention is to develop 15-16 gas fields in the period 2004-2007 on the basis of significant reserves found by private concession holders. As a potential supplier to a regional market Syria should have an interest in ensuring that the market develops in a fair and transparent manner. There has been some loosening of the vertical integration, but the sector remains firmly in state hands. The Syrian Petroleum Company (SPC) owns the natural gas reserves on behalf of the Ministry of Petroleum and Mineral Resources. Until recently it was also the owner and operator of all pipelines. In February 2003 the Syrian Gas Company was created by Presidential Decree under the Ministry, and charged to plan for the exploitation and marketing of gas and to contract gas from domestic and foreign sources to meet the national needs. A second company, the Syrian Gas Distribution Company, was established in April 2003 with the duty to develop, operate and maintain the networks for distributing gas to residential consumers. It is intended to supply initially the cities of Damascus, Homs, Hama, Lattakya and Aleppo. These steps are welcome, but much more remains to be done before such a market would be consistent with competitive wholesale supply and free international exchanges.

The regime of regulation for upstream hydrocarbons lacks many of the features desirable in a liberal system. The Ministry of Petroleum and Mineral Resources licenses all acreage to the SPC which then sub-contracts by negotiation to international oil companies through a PSC for the exploration and production activities. The SPC forms a joint operating company with the IOC's for the execution of the PSC and manages the relationship with the contractors. This regime gives the SPC a dominant position that reduces efficiency and effectiveness. The Ministry of Petroleum and Mineral Resources, or an independent body, should be assigned these licensing and regulatory functions. The fiscal regime for hydrocarbons also has some undesirable features. It is based upon a PSC with a negotiable royalty and features other non-transparent negotiable terms for profit sharing and non cost-recoverable bonuses. A review of the whole fiscal structure including the role and rights of the foreign investor and the distribution of income between the parties is required to determine the changes required to encourage investment.

Both existing refineries are state owned and pipelines are controlled by the Syria Company for Oil Transport. Distribution is the responsibility of the Syrian Company for the Storage and Distribution of Petroleum Products. Provision needs to be made for the entry of competing firms and access to strategic assets. Petroleum products are lower than in the EU and the refineries in their present configuration are not capable of meeting EU specifications. Petroleum products prices are heavily subsidized and controlled by government and there are no published ex-refinery prices. The pricing system needs to be made more transparent and needs to allow profitable operation by private companies. The refineries produce relatively low yields of light products. A full-scale review of the refinery industry and its prospects within a free-trade area needs to be undertaken and published.

Given the extent of the discrepancies between the existing practice in Syria and the requirements if Syria is to play a part in a future regional market there is some justification for a significant national programmed of technical assistance and consultancy services between the EU and Syria aimed at identifying:

- The policy and legal reforms that would be needed;
- The regulatory, structural and market options;
- The investments and human capacity building that are required;
- A schedule and plan for implementation.

Such a project should be extensive and comprehensive in the last three years. It should only be undertaken if the Government of Syria has clearly concluded that it wishes to follow the reform option and is convinced that it is appropriate to the country and conditional that such assistance and would not be achievable without that support.

7. Electricity Sector Reforms and Poverty

Although any reforms in the electricity sector in Syria will give several economic advantages to this sector, however, there should be a careful approach to reform conditions, especially with regard to electricity tariffs and petroleum products prices. If the end target is to reach a regional free market in 2010-2015, there should be market free prices for all energy products including electricity. The real challenge will be faced at this stage, which is what strategy have to be adopted when changing from direct subsidy to targeted subsidy without deteriorating the living of economically vulnerable social classes and low income people.

We need to develop a policy to direct the subsidy to these sections of the population. The application of a targeted subsidy instead of direct subsidy will lead to improvement of power efficiency and will create the encouraging investment atmosphere for local and international entrepreneurs to invest in power generation and distribution and this will eventually minimize the government economic financial burden with regard to investment in power generation and distribution.

The following points have to be taken into consideration when electricity sector reform policy is sought:

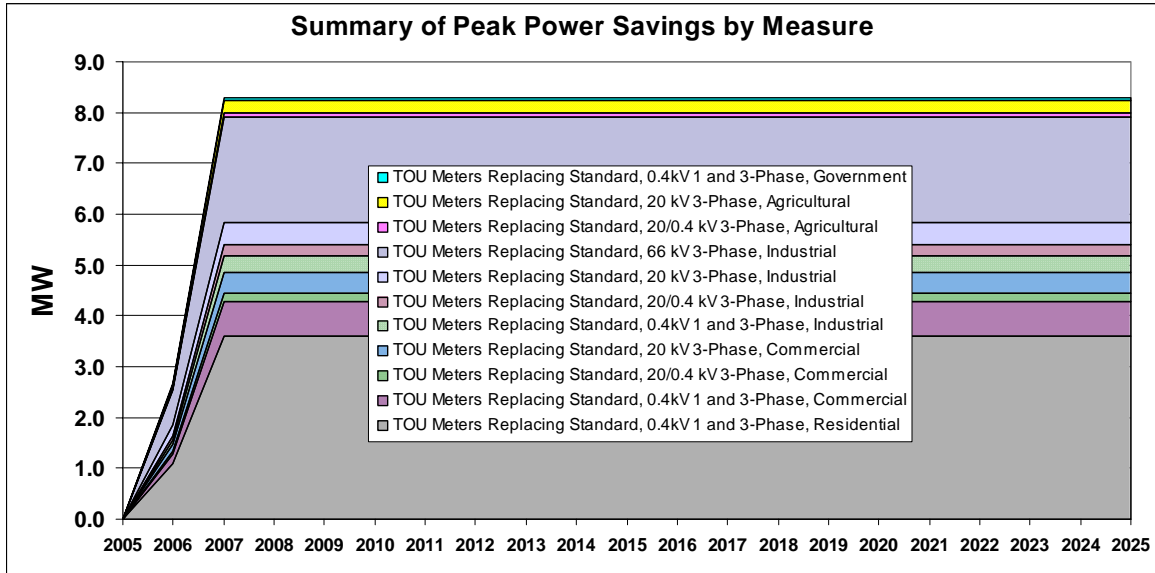
- There should be a balance between the tariffs of electricity and diesel fuel prices. Any increase in the price of one product should be accompanied with similar increase in the other product price.
- Application of a proper compensation policy for government and on pension staff based on a mechanism leading to a fair balanced compensation to different categories of the staff.
- Special care has to be taken to compensate the economically vulnerable and low income families according to specific policy. These social groups have to be classified based on a census carried in Syria which will help to classify geographically and financially all sections of Syrian society.
- The prices have to be liberalized gradually till 2010 accompanied with financial compensation.
- Any price increase have to be in parallel with a public campaign to improve the public awareness and power efficiency as well as implementation of encouraging measures to expand the use of renewable energy resources.

8. Effect of Tariff Structures on Households:

Time-of-Use Meters Pilot Program

The Time-of-Use (TOU) Meters Pilot Program addresses both a peak power savings opportunity and a key need for the PEDEEE distribution system. TOU meters can provide, when offered in combination with an effective TOU rate structure, significant peak power savings to the utility and power cost savings to the participating customer. In addition, the vast majority of meters in the PEDEEE system are badly in need of replacement. Replacement of aging meters with modern meters that allow recording of consumption under multiple tariffs during the day, as well as remote

meter reading and data gathering, can help PEDEEE save on meter reading costs, vastly improve its data gathering and billing efficiency, and, as the newer meters are more tamper-resistant, reduce illegal consumption of electricity. The TOU Meters Pilot Program is designed to test the application of TOU meters in significant numbers in each of the meter classes and sectors in Syria. The two-year program would install TOU meters in an area, for example, fed by a common substation, though some larger customers outside the substation area might also be included in the program.



Discussion of Results

TOU metering offers the potential for significant peak power and electricity system costs savings in Syria. Research is needed, however, to better determine the additional costs of TOU meters and related equipment and software, though changes in these parameters seem unlikely to substantially affect cost-effectiveness of the program. A well-designed and carefully implemented pilot TOU metering program would be of substantial use in demonstrating both the direct (cost and peak savings) and indirect (meter-reading and billing efficiency improvements, reduction of illegal consumption) benefits of TOU metering programs in Syria, as well as in identifying the social, cultural, and organizational factors that are most important for the success of a full nationwide TOU metering program. One key for this program will be designing and providing consumers with information on TOU tariffs in such a way that consumers clearly understand that the TOU tariffs are designed not for higher revenue, but to provide an incentive to save peak power. The benefits to the consumer of reducing peak power usage should be made clear, and meters and bill designs should be chosen that make clear to consumers when TOU rates are in effect, and what savings have been achieved.

For this pilot program, a well-designed and thoroughly carried-out program of monitoring and evaluation will be necessary to clearly track program costs, estimate program benefits, and note customer acceptance of and satisfaction with the program and its component measures. This monitoring and evaluation program must be designed at the same time as the program itself is designed.

9. Summary

This report has provided an overview of the energy scene in Syria and the various policies that the Syrian Government is undertaking to meet the challenge of steadily increasing energy consumption in the country. Energy demand has increased from 12.6 MTOE in 1995 to about 16.5

MTOE in 2005, which represents an average annual increase of about 4.5%. Electric energy and peak demand stood at 31860 GWh and 5770 MW in 2004, respectively, and are expected to increase at an average rate of in the range 3.9 to 4.9% over the next 15 years. The main energy sources used are Oil Products, Natural Gas, Electricity, and Renewable (mainly hydro-electricity and wood fuel). This should be noted against an economic situation that has been mildly improving; the GDP at constant 2000 prices has risen from about SP 904 Billion in 2000 to about SP 1004 Billion in 2003, which represents an average annual increase of about 3.6%. The fact that all fuel resources consumed in Syria are domestic provides a positive bearing on the economy of the country. The electricity tariff for the residential sector is still subsidized but is now moving in a new trend towards making electricity users, especially the large users and the productive sectors to pay more or less the real price of electricity production. The current tariff is stratified with a life line rate of 25 p/ kWh (i.e. 0.5 US c/ kWh). The tariff for monthly consumption above 300 kWh is 250 p/ kWh, which is up from 75p/ kWh. The percent of population below the lower level of poverty is 11.4 % of total population, based on the Syrian poverty line of about 44 SP/day per capita (i.e., one dollar per day). Poor people live primarily in rural areas and are less educated, with 81.3 % of them at the elementary education level or lower with a larger family size. A survey about energy consumption in non electrified communities in three Homs, Hama, Al-hassakeh is a first step in all Syrian remote areas. The results show that considerable quantities of consumed oil products are used for the purpose of lighting, cooking, water and space heating with an inefficient use of these sources. Electricity use by people of these communities has been in the usage of 4770 of car batteries to operate TVs.

The electricity sector in Syria should concentrate on the rehabilitation of old generating units and to convert existing single gas turbine units to combined cycle units. As Syria has a large reserve in natural gas it is expected to increase the dependency of electricity generation on this fuel. In addition it is also expected to increase the dependency on renewable energies (solar, wind, biomass) and to improve and enhance power systems interconnections with Arabic countries and Turkey. In a regional electric energy market, Syria is a potential supplier and should have an interest in ensuring that the market develops in a fair and transparent manner. In this respect, there has been some loosening of the vertical integration, but the sector remains firmly in state hands. If the end target is to reach a regional free market in 2010-2015, there should be market free prices for all energy products including electricity. The real challenge that will be faced at this stage is which strategy has to be adopted when changing from direct subsidy to targeted subsidy without deteriorating the living of economically vulnerable social classes and low income people. We need to develop a policy to direct the subsidy to these sections of the population. The application of a targeted subsidy instead of direct subsidy will lead to improvement of power efficiency.

The main barriers responsible for the relatively limited development and acceptance of renewable energy is the absence of an effective organization which act as a driving force, a heavily subsidized conventional energy sector, and a predominant public sector renewable energy industry, with no particular incentives to respond to market driven economic signals. This is being addressed by the new the National Energy Research Center (NERC), created in mid 2003 through the preparation of an energy policy project and the establishment of regulations regarding energy and environment. Possible policy instruments are to give low interest loans to purchase efficient appliances and the reduction of taxes and the charge dues. NERC is now preparing a National Renewable Energy Master Plan (REMP) with an implementation period extending over a period of 10 years, from 2002 to 2011. It is expected that in the final year of the master plan the contribution by renewable energy technologies is estimated at 1012 thousands TOE representing 4.31% of total energy consumption. NERC is preparing a legal framework base on which permits for the establishments of corporate entities who will start projects or ventures between the public and private sectors. Foreign currency deposits, plan, equipment and materials' import, profits and revenue to increase project capital and intangible assets from patents, trade marks are all considered as foreign capital.

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