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PROGRESS MADE IN THE IMPLEMENTATION OF THE WORK PROGRAMME

**ENERGY CONSERVATION IN THE
HOUSEHOLD SECTOR IN THE SYRIAN ARAB REPUBLIC**

Note by the secretariat

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FOREWORD

This report was prepared in accordance with the programme element 3.2 of the Energy Programme in the Programme of Work and Priorities for the Period 1984-1985. The programme element relates to energy conservation in the household sector in a selected ESCWA country. The household sector in the Syrian Arab Republic was selected as the subject of a field study that dealt with the assessment of energy requirements and consumption and proposed methods for improving the efficiency of its utilization.

The preparation of this report has necessitated the carrying out of a field study which was conducted by a group of experts from the Central Statistical Office in the Syrian Arab Republic.

It should be noted that the scope of this report was restricted to electric power owing to its special significance in household usage and the possibility of rationalizing its consumption.

INTRODUCTION

The electricity sector is undergoing great and rapid development so as to meet the mounting demand for electric power. This is attributable to the ever-increasing economic and social developments of society in the Syrian Arab Republic, the notable expansion of the electric network which now supplies most parts of the country and the principal, almost complete dependence on electric power in all living facilities. These factors contributed to the growth of consumption at rates higher than the installed electric capacity available for production.

Electric power consumption increased at the rate of 19.9 per cent on the average between 1980 and 1984 in order to meet the growing consumption demand in the areas of lighting, industry, etc. At the installations and facilities of the Public Establishment for Electricity, power generation from various hydroelectric, steam, gas and diesel sources rose from 3.837 million kWh to 6.897 kWh during the same period.

However, despite the increase between 1980 and 1984 of the per capita share of electric power produced from various sources an increase from 441.2 kWh for lighting purposes alone to 786 kWh, these averages remained low compared with the averages attained at the international level and in some advanced countries. No doubt, this low rate does not mean that it is necessary to encourage excessiveness in power consumption. Rather, it necessitates equitable utilization and distribution of electric power in all areas of the country provided that this is accomplished with optimal efficiency and with the utilization of rationalization techniques superior to the present ones.

The cumulative sum of the capital invested in projects undertaken by the Public Establishment for Electricity rose from around 3.566 million Syrian pounds in 1980 to 15.002 million Syrian pounds in 1984, thus registering within four years an increase of more than three times the investments in 1980. The actual expenditure on projects undertaken by this Establishment was around 686 million Syrian pounds in 1984 alone, or the equivalent of 76 per cent of the total appropriations allotted for this purpose in that year.

It is expected that the demand for electric power will register a considerable increase during the coming years as a result of the envisaged economic and social development. This necessitates effecting a considerable increase in the generated capacity so as to produce electricity and meet the required needs, hence the allotment of additional appropriations for erecting and operating electric power installation. This need renders the rationalization of energy consumption in the household sector and in other sectors a pressing issue.

I. METHODOLOGY

A. Objectives

This study was aimed at determining the following:

1. What major electrical devices and appliances were possessed by families;
2. The extent of the proliferation of the use of solar energy for house heating and water heating;
3. The residents' awareness of the reasons for power failure;
4. The nature of damages resulting from repeated disconnection and reconnecting of the electric current;
5. The residents' opinions with regard to the sources of electric power wastage;
6. The nature of the measures adopted to control and rationalize consumption;
7. Alternative energy used during the period of power failure;
8. Proposed procedures and measures to assist in economizing electric power.

B. Scope of research and method of implementation

This study comprised a random sample of families residing in the three principal cities of Damascus, Aleppo and Homs. A number of trained researchers completed the required data in the questionnaire of the study by following the direct visitations method to families residing in selected areas.

C. The size of the sample and method of selection

The research sample covered 1,000 families and it was distributed among the three cities in accordance with the ratio of the number of families in each according to the results of the 1981 census. The sampling fraction was 2.4 per 1,000.

A number of streets were chosen in situ in selected quarters of these cities with all types of buildings in terms of age, modernity and principal structural materials. These served as indicators of the socio-economic levels of the families. Data from families living in these streets were completed with the help of trained supervisors.

D. The research questionnaire

In designing the research questionnaire, due attention was given to easy and smooth classifying of the data both manually and mechanically. Answers to the questions contained in the questionnaire were semi-coded. The interviewers placed in the appropriate square for each multiple-choice answer. Alternately, the researchers recorded the answer in the space designated for that purpose.

The questionnaires contained data relevant to the objectives of the research. These data covered the following:

1. Geographic data;
2. Data of a general nature including current occupation and educational status of the husband and wife, the number of household members, the enrolment of the children in schools and universities and the number of rooms in the house;
3. What electrical appliances and devices are owned by the family; the provision of solar energy in the house for the purposes of heating; water heating; and central heating installations.
4. Data on the rationalization of power including the value of the latest electricity bill; reasons for power failure; sources behind wastage of electric power; the periodicity of power failure and the position of the family in that regard; the effects of power failure; the nature of procedures followed in rationalizing the consumption of electric power; alternative sources of energy during the period of power failure; and the family's suggestions with regard to economizing power.

E. Procedural definitions

(a) The household

For the purpose of this research, this denotes the household's family which comprises household members who share dwelling and living arrangements;

(b) Head of the household

In this study this refers to both the husband and the wife;

(c) The room

This is a roofed space used for living, sleeping or eating; hence facilities such as bathrooms and kitchens are not included in this definition.

F. Classification of results

Manual classification of data was carried out by a number of people in accordance with previously prepared tables for entering data so as to realize the objectives of the research.

II. RESEARCH RESULTS

A. Household composition in terms of expenditure on electric power

Whereas the latest electricity bill (which normally covers 60 days) paid by 1.5 per cent of the total households, was less than 50 Syrian pounds, 10 per cent of the total households expended over 400 Syrian pounds. Households that paid bills of up to 200 Syrian pounds comprised 64 per cent of the total number of households.

Table 1

Distribution of households by size and the latest electricity bill
(percentage)

Size of household	Value of the latest electricity bill (SP)										Total
	50	-50	-75	-100	-150	-200	-250	-300	-400	+500	
2	0.5	1.0	0.5	1.0	-	0.5	-	0.5	-	-	4.0
3	-	0.5	4.0	2.5	1.5	0.5	1.5	-	-	0.5	11.0
4	-	1.5	3.0	2.0	1.5	0.5	-	1.5	-	2.0	12.0
5	1.0	1.5	0.5	0.5	5.0	3.0	1.0	1.5	1.5	2.0	17.5
6	-	1.0	1.5	4.0	5.0	0.5	1.0	3.0	0.5	1.0	17.5
7	-	0.5	1.0	2.0	2.5	3.5	1.0	0.5	-	0.5	11.5
8	-	0.5	1.0	1.0	1.0	1.5	0.5	0.5	0.5	-	6.5
9	-	0.5	0.5	1.0	3.0	1.0	0.5	1.0	-	0.5	8.0
10	-	1.0	-	1.5	-	0.5	-	0.5	-	-	3.5
11	-	0.5	-	1.5	0.5	-	1.0	0.5	-	0.5	4.5
12	-	-	0.5	0.5	-	-	0.5	0.5	-	0.5	2.5
13	-	-	-	0.5	1.0	-	-	-	-	-	1.5
Total	1.5	8.5	12.5	22.5	19.0	9.5	7.5	9.0	2.5	7.5	100.0

The average amount paid per household for the latest electricity bill was 216.15 Syrian pounds. This average ranged between 125.5 Syrian pounds, in households composed of 4 members, and 367.5 Syrian pounds in households composed of 12 members. In other words, a household's consumption of electric power is directly proportionate to its size.

On the other hand, the value of the electricity bill varies with the variation of the number of rooms in the dwelling of the household members. Table 2 demonstrates this.

Table 2

Distribution of households by number of rooms

Number of rooms	Value of the latest electricity bill (SP)										Total
	50	-50	-75	-100	-150	-200	-250	-300	-400	+500	
1	-	1.0	0.5	-	-	-	-	-	-	-	1.5
2	-	1.5	0.5	1.5	1.0	0.5	0.5	-	-	-	5.5
3	0.5	3.0	5.0	5.5	4.5	1.0	-	1.0	0.5	1.0	22.0
4	1.0	3.0	6.0	8.5	7.0	2.5	3.0	3.0	0.5	1.0	35.5
5	-	-	0.5	5.5	3.0	4.0	1.5	2.0	-	3.5	20.0
6	-	-	-	0.5	2.5	1.0	2.5	1.5	1.5	2.0	11.5
7	-	-	-	0.5	1.0	0.5	-	1.5	-	-	3.5
8	-	-	-	0.5	-	-	-	-	-	-	0.5
9	-	-	-	0.5	-	-	-	-	-	-	0.5
Total	1.5	8.5	12.5	22.5	19.0	9.5	7.5	9.0	2.5	7.5	100.0

The average value of the later electricity bill ranged between 70 and 80 Syrian pounds for household members residing in one room and 345 Syrian pounds for household members residing in six rooms. Naturally, the increase in the number of rooms is concomittant with the increase in electricity consumption.

B. Possession of electrical appliances and devices

The households possession of various electrical appliances and devices varies in accordance with their types and with the occupation of the husband and the wife in terms of participation in economic activity.

Table 3
Distribution of households by possession of electrical appliances,
occupation of the husband and participation of
the wife in economic activity
(percentage)

Electrical appliances and devices	Husbands by occupation and possession of electrical appliances						Wives by occupation and possession of electrical appliances						Total
	Government officials		Professional		Buying and selling		Others		Employed		Unemployed		
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
Radio	47.5	1.5	24.5	2.0	16.5	0.5	6.5	1.0	20.0	0.5	75.0	4.5	100.0
Television	46.5	2.5	25.0	1.5	16.5	0.5	7.0	0.5	20.0	0.5	75.0	4.5	100.0
Video	15.5	33.5	8.0	18.5	8.0	9.0	3.0	4.5	8.0	12.5	26.5	53.0	100.0
Refrigerator	47.0	2.0	23.0	3.5	16.0	1.0	6.5	1.0	18.5	2.0	74.0	5.0	100.0
Freezer	17.0	32.0	9.5	17.0	5.5	11.5	2.0	5.5	8.0	22.5	26.0	53.5	100.0
Washing machine	45.5	3.5	23.0	3.5	16.5	0.5	6.0	1.5	19.0	1.5	72.0	7.5	100.0
Fan	38.0	11.0	19.5	7.0	15.0	1.5	6.0	1.5	16.0	4.5	62.5	17.0	100.0
Air conditioner	8.5	40.5	4.0	22.5	3.0	14.0	1.0	6.5	2.5	18.0	14.0	65.5	100.0
Iron	46.5	2.5	22.5	4.0	16.5	0.5	7.5	-	20.5	-	72.5	7.0	100.0
Heater	28.5	20.5	15.0	11.5	10.5	6.5	3.5	4.0	13.5	7.0	44.0	35.5	100.0
Vacuum cleaner	22.0	27.0	9.5	17.0	11.5	5.5	2.0	5.5	11.0	9.5	34.0	45.5	100.0
Hair dryer	37.0	12.0	16.0	10.5	14.5	2.5	5.5	2.0	18.0	2.5	55.0	24.5	100.0
Sewing machine	11.0	38.0	9.0	17.5	7.0	10.0	2.5	5.0	4.0	16.5	25.5	54.0	100.0
Mincer	34.5	14.5	15.5	11.0	14.5	2.5	4.5	3.0	15.5	5.0	53.5	26.0	100.0
Boiler	23.0	26.0	11.5	15.0	5.5	11.5	2.5	5.0	11.5	9.0	31.0	48.5	100.0
Central heating	11.0	37.5	4.5	22.0	7.5	9.5	1.0	6.5	1.0	19.5	23.5	56.0	100.0

It can be deduced from the previous table that by and large, the possession of electrical appliances and devices ranged between a minimum of 16.5 per cent for air conditioners and a maximum of 95 per cent for both radios and television sets.

The possession of both radios and television sets reached its maximum, which was 97.1 per cent, among households with economically active wives, whereas the possession of air conditioners reached its minimum, which amounted to 15.1 per cent, at the level of households with professional husbands and an even lower minimum of 12.2 per cent at the level of households with economically active wives.

C. The utilization of solar energy for heating houses and water

The utilization of solar energy for heating houses and water is still limited although the Syrian Arab Republic is among the richest countries in terms of hours of sunshine and the intensity of sun rays.

The results of this research indicated that only 5.5 per cent of the households use solar heating devices to meet the requirements of house and water heating. This percentage ranges between 4.1 per cent of the total households whose heads work for the state or for the public sector and 5.9 per cent of the total household whose heads (the husbands) are engaged in buying and selling; it ranges between 2.4 per cent among economically active wives and 6.7 per cent among housewives fully devoted to family and domestic affairs.

D. Periodicity of power shut-downs

Forty-one per cent of the households stated that power shut-downs occurred at regular daily intervals. The replies of the rest of the households were in contradiction to this estimate.

Twenty-six per cent of the households replied that the timing of the power shut-downs was inconvenient, while the remaining families found it convenient.

Table 4

Distribution of households by periodicity of power shut-downs and convenience or inconvenience

(Percentage)

Periodicity	Convenience or inconvenience of the timing		Total
	No	Yes	
Yes	22.5	18.5	41.0
No	3.5	55.5	59.0
Total	26.0	74.0	100.0

E. Reasons for power shut-downs

Following are the reasons for power failure according to relative importance:

- (1) Inefficiency of production;
- (2) Wastage in consumption;
- (3) Maintenance of generators;
- (4) Expansion in the electric grid and provision of lighting to streets and squares;
- (5) Illegal usage of the electric grid;
- (6) The mounting increase of the use of electrical appliances.

It is worth noting that 39 per cent of the total number of husbands who attributed power shut-down to the inefficiency of production had university degrees. This figure is against 12.1 per cent of the total number of wives holding such degrees. As to the husbands, 34.3 per cent who attributed power failures to wastage in consumption had university degrees against 11.5 per cent of the wives who held similar degrees. As for households that attributed power shut-downs to the maintenance of the generators, 38.6 per cent of the husbands had required university degrees against 10.5 per cent of wives. Finally 83.3 per cent of the husbands who attributed power failure to the expanded network and to the lighting of streets and squares were university graduates against 16.6 per cent of wives who held university degrees.

F. Impact of repeated power shut-downs

Twenty-six per cent of the total number of households testified that repeated power shut-downs did not inflict any damages on them. Among them, 63.5 per cent had children registered in schools and universities against 36.5 per cent who did not. Seventy-four per cent of the total number of households mentioned that repeated power shut-downs had inflicted damage in the following order:

- (1) Breakage of one of electrical appliances or devices;
- (2) Disrupting the children's study;
- (3) Complicating domestic chores.

Table 5
 Distribution of heads of households (wives and husbands)
 by reason of power shut-down and by educational status

Reason for power failure	Education status of husband				Education status of wife				Total				
	Illiterate	Reads and Writes	Primary	Inter-mediate	Secondary	University	Illiterate	Reads and Writes		Primary	Inter-mediate	Secondary	University
Inefficiency of production	4.0	11.5	9.5	7.5	10.5	27.5	14.5	12.5	8.5	8.5	18.0	8.5	70.5
Waste in consumption	3.0	9.5	9.0	4.5	5.5	16.5	9.5	9.5	7.0	7.0	10.0	5.5	48.0
Maintenance of generators	2.0	2.5	6.5	2.5	4.0	11.0	3.0	7.5	5.0	3.0	7.0	3.0	28.5
Illegal usage of the electric grid	-	0.5	-	-	0.5	0.5	-	-	1.0	-	0.5	-	1.5
Proliferation of electrical devices	0.5	0.5	-	-	-	-	-	1.0	-	-	-	-	1.0
Length of the network	-	0.5	-	-	-	2.5	0.5	-	-	-	2.0	0.5	3.0

Table 6

Distribution of households by nature of change inflicted through
repeated power shut-downs and childrens enrolment in
schools and universities

(percentage)

Infliction and nature of damages	Enrolment of children in school and universities		Total
	Yes	No	
No	16.5	9.5	26
Yes*			
- Disrupting children's studies	43.5	-	43.5
- Causing break-down of electrical appliances	33.0	15.5	48.5
- Complicating domestic chores	6.5	2.0	8.5
- Frightening children	2.5	1.0	3.5

* These percentages involve some double counting owing to the existence of more than one area of damage in some households.

The necessity of rationalizing power consumption prompted the State to adopt centralized measures such as disconnecting the electric current in accordance with a pre-determined schedule. Although the advance notice given to citizens with regard to disconnection of the electric current is a positive factor in rationalizing power consumption, there are negative aspects to this procedure, among which is the excessive use of electric power as soon as the electric current is restored.

G. Sources of wastage of electric power

Forty per cent of the total number of households believe that there is no wastage in power consumption. Heads of households (husbands) who hold university degrees constitute 27.5 per cent of these household members against 7.5 per cent of wives who hold such degrees. However, 60 per cent of the total number of households find that there is a wastage in power consumption which is attributable to a number of sources listed below in order of importance:

1. Improper use of lighting;
2. Improper use of electrical appliances;
3. Illegal usage of the lines of the electric grid.

Table 7
Distribution of heads of households (husbands and wives) by wastage in consumption of electricity and educational status

Presence and sources of wastage	Heads of households (husbands) by educational status					Heads of households (wives) by educational status					Total		
	Illiterate	Reads and Writes	Primary	Inter-mediate	Secondary	Illiterate	Reads and Writes	Primary	Inter-mediate	Secondary			
No	2.5	8.0	8.0	4.5	6.0	1.0	10.0	7.5	7.0	4.0	8.5	3.0	40.0
Improper use of lighting	2.0	7.5	8.0	3.0	7.5	17.0	8.0	9.0	6.5	7.0	9.0	5.5	45.0
Improper use of electrical appliances	3.5	6.5	4.5	2.5	4.5	11.0	8.5	5.0	4.0	2.5	8.5	4.0	32.5
Excessive lighting of streets	-	-	0.5	-	0.5	2.0	-	1.0	0.5	-	1.0	0.5	3.0
Excessive lighting of public buildings	-	-	-	0.5	0.5	1.5	-	0.5	0.5	0.5	1.0	-	2.5
Expansion of the electric grid	-	-	-	-	-	0.5	-	-	-	-	0.5	-	0.5
Illegal usage of the electric grid	-	-	-	0.5	-	0.5	-	-	0.5	-	-	0.5	1.0

H. Measures for rationalizing power consumption

The results of this research revealed that 21 per cent of the total number of households do not undertake any measures to rationalize their consumption and that 59.5 per cent of the heads of households (husbands) had completed primary school or less against 73.8 per cent heads of households (wives) who held primary degrees or less.

On the other hand, 58 per cent of the total number of households said that they were undertaking measures to rationalize and control their consumption of electric power. Following are some of these measures listed according to importance:

- (1) Turning off unnecessary lights;
- (2) Decreasing the number of hours for operating electrical appliances or other unnecessary appliances;
- (3) Reducing the period for television watching;
- (4) Replacing ordinary lights with neon lights.

I. Alternate sources used during power shut-downs

Sources of alternative lighting used by households were as follows listed in order of their relative importance:

- (1) Kerosene lamp;
- (2) Gas lamp;
- (3) Candles;
- (4) Battery-operated light;
- (5) Electric generator.

It is worth noting that the percentage of households that used electric generators during power shutdowns was negligible and therefore inconsequential.

Table 8
Distribution of heads of households (husbands and wives) by measures undertaken for
rationalization of power consumption and their nature and by educational status

Measures undertaken to rationalize power consump- tion and their nature	Heads of households (husbands) by educational status			Heads of households (wives) by educational status			Total						
	Illiterate and Writes	Primary mediate	Secon- dary univer- sity	Illiterate and Writes	Primary mediate	Secon- dary univer- sity							
No	2.0	0.5	5.5	1.5	2.5	4.5	6.5	5.0	4.0	1.0	3.0	1.0	21.0
Turning off unnecessary lights	4.0	11.5	10.5	8.0	11.5	27.0	14.5	14.0	9.5	9.5	17.5	8.0	73.0
Reducing the period for watching television	2.0	3.0	1.5	1.5	3.0	4.0	5.5	1.5	2.5	1.5	2.0	2.0	15.0
Decreasing the operation of electrical appliances	1.0	5.5	3.5	4.0	4.0	14.5	6.5	4.5	4.5	3.5	7.5	6.0	32.5
Exchanging lights	-	-	-	-	-	5.0	-	-	-	-	-	0.5	0.5

Table 9

Distribution of heads of households (husbands and wives)
by alternative sources of energy and by occupation

Alternative sources	Occupation of the head of the household (husband)				Occupational status of the wives		Total
	Govern- ment Official	Profess- ionals	Buying and Selling	Other	Employed	Unemp- loyed	
Electric generator	0.5	-	0.5	-	-	1.0	1.0
Kerosene lamp	22.0	7.5	9.0	2.0	8.0	32.5	40.5
Gas lamp	17.0	11.5	6.0	3.5	8.0	30.0	38.0
Battery-operated lamp	11.5	9.5	6.5	2.5	6.5	23.5	30.0
Candles	20.5	8.0	6.0	1.5	5.0	31.0	36.0

J. Proposed procedures and methods for economizing on electric power

Following are some procedures and methods that could be used to rationalize power consumption listed in order of relative importance.

(1) Consciousness-raising among citizens with regard to non-wastage of power, methods of rationalizing electric power consumption and the reduction, in so far as possible, of the use of electrical appliances;

(2) Replacement of high-consumption light bulbs and light fixtures by other neon bulbs;

(3) Controlling the electric grid and preventing its violation;

(4) Encouraging the utilization of solar energy;

(5) Formulation of a pricing policy aimed at rationalizing the consumption of electric power while observing the economic and social conditions of the various categories.