

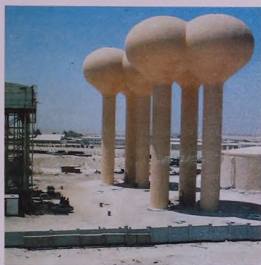
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1984



STATE OF BAHRAIN
MINISTRY OF WORKS, POWER AND WATER
POWER AND WATER AFFAIRS

POWER & WATER AFFAIRS

ANNUAL REPORT 1984



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CENTRE FOR ARAB GULF STUDIES

UNIVERSITY OF EXETER



11 OCT 1988

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1984



*His Highness Shaikh Isa bin Salman
Al Khalifa, Amir of Bahrain.*



*H.E. Shaikh Khalifa bin Salman
Al Khalifa,
the Prime Minister.*



*H.E. Shaikh Hamad bin Isa
Al Khalifa, Crown Prince and
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POWER & WATER AFFAIRS ANNUAL REPORT 1984

INTRODUCTION

Technology and Talent: Sustained Thrusts of 1984

The key issues for 1984 were advances in technology in response to increased consumer demand, and the progress on the Bahrainisation programme within Power and Water Affairs.

Emphasis was given on supplying more homes and industries with adequate electricity and water. The most tangible achievements were the 10% increase in electrical efficiency and the commissioning of two 5MIGPD Distillers at Sitra Power Station and the 4 X 75MW Gas Turbine Generators at Riffa II Power Station (for the Electricity Directorate), and the commissioning of the Reverse Osmosis (RO) Plant at Ra's Abu Jarjur (for the Water Affairs Directorate).

Most of the projects started in 1982 and 1983 were completed in the later part of 1984. More significantly, these projects will form the backbone of expansion activities from 1985 onwards.

Advanced technology proved to be crucial in planning and executing the projects throughout Power and Water Affairs. However, the manpower factor is instrumental in carrying them out. Today, highly skilled and semi-skilled Bahrainis comprise 80% of Power and Water Affairs workforce, occupying posts at all levels.

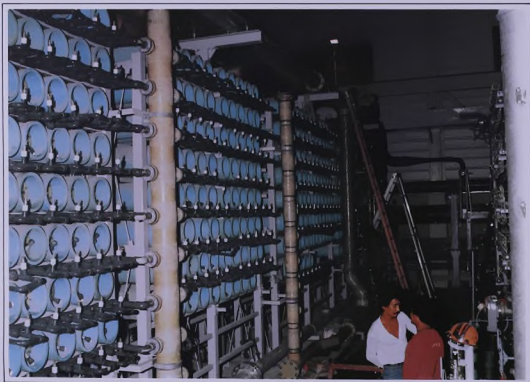


Power and Water Affairs is leading the way in producing competent technicians and professionals from among the local population. With new training centres, management aids, seminars and instructional clinics conducted throughout the year, the Government's goal of total self-reliance thus becomes more attainable.

Progress can only be judged by the quality of services extended to the greatest number of consumers. To underscore the advances made in this area: The Electricity Directorate connected 6,791 new

consumers in 1984, and the Water Supply Directorate produced an average of 485.5 litres of potable water per head per day in the same year, or an increase of 13.7% over 1983 ... to mention only the highlights of operations.

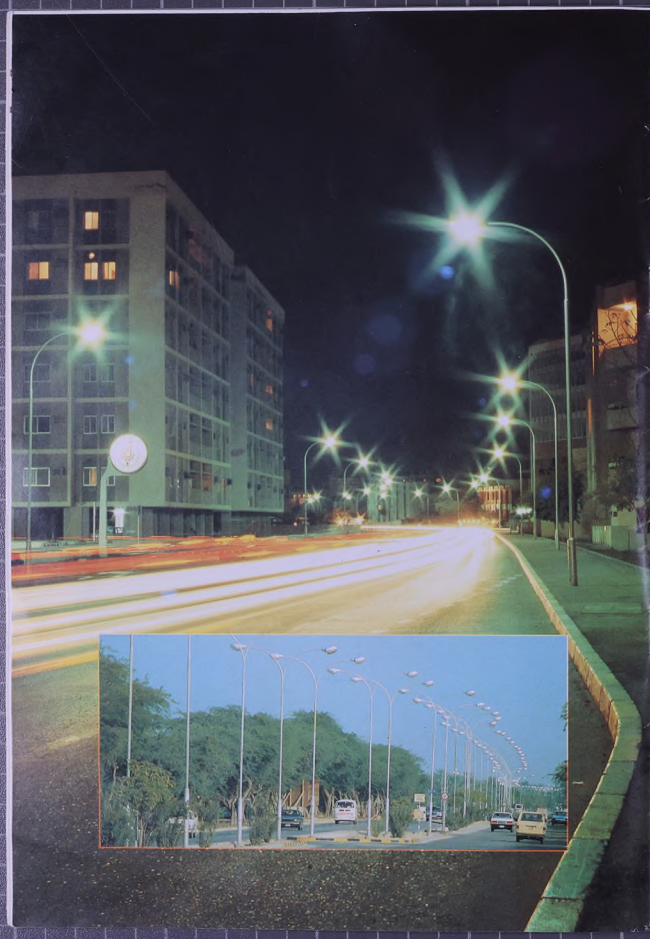
Sustaining the momentum of technology and talent is the greatest challenge which the Directorates within Power and Water Affairs face in the coming years. Bahrain continues to demand more from man and machine.



ELECTRICITY DIRECTORATE

Major and support projects were accomplished by the Electricity Directorate in 1984 despite large cuts in the number of outside labour and overtime work. This is a clear indication that the Electricity Directorate, and Power and Water Affairs as a whole, are gaining ground towards self-sufficiency.

Numbers, however, speak louder than words. In 1984, electrical efficiency in production increased from 20.56% to 24.45%. An increase of 10.1% in total units generated with a 7.6% decrease in fuel consumption.



Production Facts

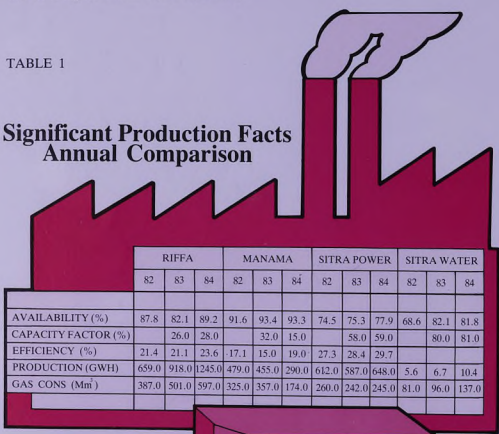
Consistency in production performance was underscored by the trend of increased efficiency and installed capacity which has been established from 1982 to 1984.

The Maximum Demand in 1984 of 514 MW was 4.9% higher than in 1983. Meanwhile,

gas usage for both Power and Water dropped markedly. See Table 1 for significant production facts.

TABLE 1

Significant Production Facts Annual Comparison



	RIFFA			MANAMA			SITRA POWER			SITRA WATER		
	82	83	84	82	83	84	82	83	84	82	83	84
AVAILABILITY (%)	87.8	82.1	89.2	91.6	93.4	93.3	74.5	75.3	77.9	68.6	82.1	81.8
CAPACITY FACTOR (%)		26.0	28.0		32.0	15.0		58.0	59.0		80.0	81.0
EFFICIENCY (%)	21.4	21.1	23.6	17.1	15.0	19.0	27.3	28.4	29.7			
PRODUCTION (GWH)	659.0	918.0	1245.0	479.0	455.0	290.0	612.0	587.0	648.0	5.6	6.7	10.4
GAS CONS (Mm)	387.0	501.0	597.0	325.0	357.0	174.0	260.0	242.0	245.0	81.0	96.0	137.0

	TOTALS		
	82	83	84
MAX DEMAND (MD)	441.0	490.0	514.0
PERCENT INCREASE	6.5	11.0	4.9
WATER PRODUCTION (Mm)	5.6	6.7	10.4
PERCENT INCREASE	44.0	19.0	55.0
ELECTRICAL EFFICIENCY (%)	21.6	20.56	24.45
INSTALLED CAPACITY (MW)	533.0	683.0	983.0
GAS CONSUMPTION (Mm)	1053.0	1196.0	1153.0
ENERGY SUPPLIED (GMH)	1760.0	1986.0	2187.0
PERCENT INCREASE	12.9	11.0	10.1

The generation maintenance and repair expenditure allocated for outside contractors showed an important area of expenditure reduction. In 1983, dependence on contractors decreased to BD716,376 from the 1982 cost of BD3.4

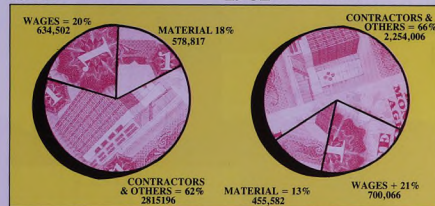
million (Actual Cost: Wages, Material, Contractors, Others). The trend in self-reliance brought about an even more drastic cut in cost allocation for contractors — down to about BD150,000 in 1984.

TABLE 2

Expenditure 1981 & 1982 Generation Maintenance and Repair

1981 ACTUAL BD 4,028,515

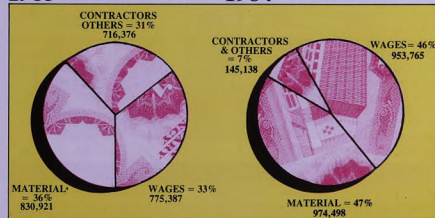
1982 ACTUAL BD 3,409,664



Generation Maintenance and Repair Expenditure 1983 & 1984

1983 ACTUAL BD 2,322,684

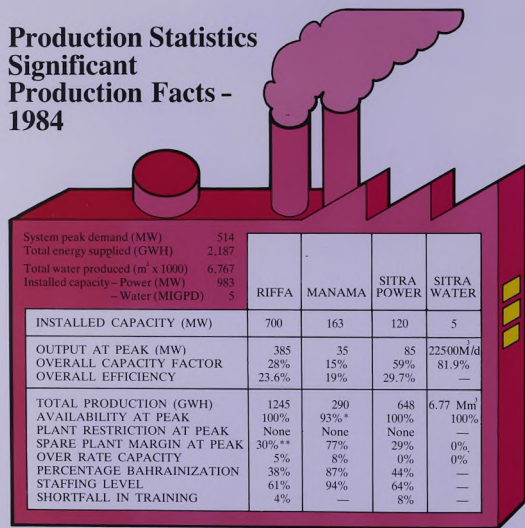
1984 ACTUAL BD2,073,402



The general improvement in efficiency can best be seen in the upward trend in station availability and capacity factors of the four major power and water stations.

TABLE 3

Production Statistics Significant Production Facts - 1984



* JB2 out for protection modifications, which were scheduled for an earlier date, but delayed for outside reasons.

** Installed capacity at peak 550 MW.

Systems Operations

The System Peak Demand of 514 MW is directly attributed to the high temperatures during the summer of 1984, which hovered near the 40s. The peak occurred at 22.40 hours on Tuesday 31st July, and was equivalent to a 4.9% increase over the peak demand in 1983. Conversely, the demand was lowest in January, recorded at 82 MW, as temperatures dipped.

Table 4 illustrates the breakdown of total electrical units generated by the major power stations, with Riffa consistently generating the highest number of units in 1983 and 1984.

TABLE 4

Breakdown of Gas Consumption

STATION	UNITS GENERATED		PERCENTAGE OF TOTAL GAS CONSUMED	
	1983	1984	%	%
	NM x 10 ⁶	NM x 10 ⁶		
MANAMA	357,323	174,494	29.87	15.13
RIFAA	501,046	597,102	41.89	51.77
SITRA - ELECTRICITY	241,685	244,948	20.20	21.24
- WATER	96,183	136,842	8.04	11.86
TOTAL	1196,237	1153,386	100.00	100.00

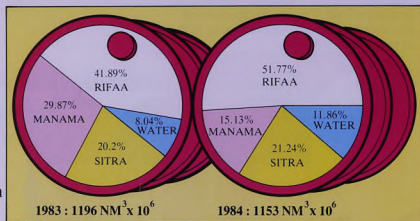
Breakdown of Electrical Units Generated

STATION	UNITS GENERATED		PERCENTAGE OF TOTAL ELECTRICAL UNITS GENERATED	
	1983	1984	1983	1984
	GWH	GWH	%	%
MANAMA	450,412	286,326	23.09	13.37
RIFAA	912,864	1252,903	46.81	57.55
SITRA	587,033	623,020	30.10	29.08
TOTAL	1950,309	2142,339	100.00	100.00

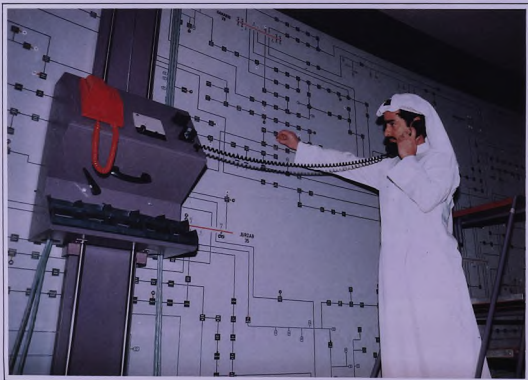
Efficient use of equipment to conserve energy helped produce more units while reducing the amount of fuel consumed. Diagram 5 shows the considerable decrease in gas consumption as a whole

(1984 versus 1983), and the percentage of gas consumption of each of the individual power and water stations.

TABLE 5



Fuel Gas Consumption 1983/1984



Distribution

Twenty percent more consumers were connected in 1984 than in 1983 with an increase in the system maximum demand of 4.9%. Significantly, this was achieved with reduced labour and overtime. The increase in the number of consumers connected involved a wide cross-section of Government, private, commercial, and industrial projects, with the commercial sector accounting for the largest number (77) of projects designed. Another highlight of the work performed was the design of power connection projects for the Ministry

of Housing, particularly Madinat Hamad, with 7 projects designed. Refer to Table 6 for details on the projects and their cost.

The responsiveness to consumer needs was reinforced by the installation of a computer system to link the Distribution Department to the Commercial Department. It presently enables quick and efficient processing of applications for power supply, and accurate information gathering on cable and consumer records.

Work Performed by the Division During 1984

TABLE 6

APPLICATIONS RECEIVED APPLICATIONS PROCESSED	NEW SUPPLY	ADDITIONAL SUPPLY
	5,269 5,499	1,491 1,174
GOVERNMENT PROJECTS DESIGNED	45	1,732,361
PRIVATE PROJECTS DESIGNED	43	1,142,128
COMMERCIAL PROJECTS DESIGNED	77	1,153,285
INDUSTRIAL PROJECTS DESIGNED	15	336,231
ADDL. LOAD PROJECTS DESIGNED	15	297,088
M.O.H. PROJECTS DESIGNED	7	1,999,089
REINFORCEMENT PROJECTS	39	1,405,521
DIVERSIONS	30	426,976
SUB TOTAL	271	8,492,679
MAJOR LV PROJECTS DESIGNED	601	1,262,318
MAJOR LV REINFORCEMENTS	26	268,361
MAJOR LV DIVERSIONS	35	129,223
SUB TOTAL	662	1,659,902
GRAND TOTAL	933	10,152,581

Construction

Five construction works at Madinat Hamad formed a major part of the work load of the Department, though this Ministry of

Housing scheme was only one of the total of 333 construction projects completed in 1984.

TABLE 7

a. Distribution Schemes			
During the year, 398 jobs were issued for construction, these are categorised as follows :		The number of schemes completed are as follows:	
1. PRIVATE SCHEMES	262	1. PRIVATE SCHEMES	230
2. REINFORCEMENT & DIVERSIONS	125	2. REINFORCEMENT & DIVERSIONS	98
3. MINISTRY OF HOUSING	11	3. MINISTRY OF HOUSING	5

b. The actual amount of work carried out	
NEW CONSUMERS CONNECTED	6791
NEW POLE-MOUNTED SUBSTATIONS ERECTED	55
NEW GROUND-MOUNTED SUBSTATIONS EQUIPPED	198
KM OF 11KV OVERHEAD LINES ERECTED	17.95
KM OF LV OVERHEAD LINES ERECTED	23.05
KM OF 11KV UNDERGROUND CABLE LAID	83.03
KM OF LV UNDERGROUND CABLE LAID	179.34

Operation and Maintenance

The actual number of routine maintenance tasks completed was markedly higher in 1984 than in 1983, despite the large cutback in outside contract labour.

to Directorate circuits. Eventually, annual repair costs showed a decline. The continuing performance of the Damage Prevention Control Unit during 1984 contributed to this welcome trend.

Productivity, however, was not the only area where Operations and Maintenance significantly improved. The year 1984 was also remarkable because it was the first year to indicate a reduction in third party faults

Tables 8 and 9 present details on actual operation and maintenance works, as well as the downward trend in overtime hours from 1982 to 1984.

TABLE 8

A. Routine Planned/Maintenance Work				
ROUTINE MAINTENANCE	12 MONTH BUDGET NUMBER	TOTAL IN 1983	TOTAL IN 1984	
11KV SWITCHGEAR	450	444	467	
11KV TRANSFORMER	420	445	486	
LV BOARD/LV ACB	420	462	524	
BATTERY CHARGES	34	20	39	
SUBSTATION INSPECTION	3000	2282	2089	
SUBSTATION CLEANED	8000	2296	1520	
SUBSTATION PAINTED	170	117	122	
IONICS PLANT				
OTHER WORK				
SUBSTATION ANCILLARY INSTALLATION	625	301	668	
CHANGE OVERLOADED TRANSFORMER	30	1	0	
OVERHAUL RETIRED TRANSFORMER	150	117	118	
OVERHAUL RETIRED 11KV SWITCHGEAR	30	9	45	
OVERHAUL RETIRED LV BOARD	24	1	2	
SEALING OF S/S ROOF		131		
B. Defects and Fault Repair Work				
	DEFECTS REPAIRED		FAULTS REPAIRED	
	TOTAL 1983	TOTAL 1984	TOTAL 1983	TOTAL 1984
11KV SWITCHGEAR	74	60	15	18
11KV TRANSFORMER	75	69	12	3
LV BOARD / LV ACB	7	12	80	69
OTHERS		0		0
C. Ionics Plant Production				
PRODUCTION GALLONS	12 MONTH ESTIMATE	TOTAL IN 1983	TOTAL IN 1984	
	200000	330770	230130	
D. Emergency Generators				
TOTAL IN 1983		TOTAL IN 1984		
NUMBER	HRS RUN	NUMBER	HRS RUN	
94	2024.5	96	2180	

TABLE 9

A. Routine Planned/Maintenance Work						
	1982	1983	1984	TARGET 1984	TARGET 1985	
ROUTINE MAINTENANCE						
11KV TERMINATIONS MAINTAINED	—	27	9	—	—	
LV TERMINATIONS MAINTAINED (WALL BOX & POLE BOX)	189	802	1961	5000	2500	
S/S LV BOARD TERMINATIONS	6	703	1663	3000	2000	
OTHER WORK						
*LV TERMINATIONS	171	256	807	250	—	
LV CABLE	12	34	72	30	—	
HV CABLE	—	—	2	5	—	
B. Defects and Fault Repair Work						
	FAULTS/DEFECTS			DEFECTS		
(EXCL. THIRD PARTY DAMAGE)	1982	1983	1984	1982	1983	1984
11KV CABLE	81	46	37	—	—	7
11KV TERMINATIONS	62	15	10	—	27	12
LV CABLE	432	361	298	—	—	3
LV TERMINATIONS — WALL BOX AND POLE BOX	1111	1381	1714	189	802	889
S/S — LV BOARD TERMINATIONS	138	76	69	6	703	17
TOTAL	1824	1879	2128	195	1532	928
THIRD PARTY DAMAGE REPAIRED	1982	1983	1984			
11KV CABLE	45	48	40			
11KV TERMINATIONS	—	4	1			
LV CABLE	202	233	181			
LV TERMINATIONS	32	14	13			
TOTAL	279	299	235			
C. Overtime Hours						
	1982	1983	1984			
	32448	27999	27389			

*LV terminations — Change position, cancellation, addition, reinforcement of wall box and pole box cancellation.

Streetlighting

The Government's increasingly deepening concern for the safety of people on the road, whether they be drivers or pedestrians, was manifested by the installation and maintenance of more street

lights on all types of roads. Recently, the Directorate placed special emphasis on street lighting for housing projects.

TABLE 10

Number of Luminaires to be Maintained					
ROAD TYPE	1981	1982	1983	1984	
MAJOR ROADS	4,323	4,951	5,197	5,724	
MINOR ROADS	1,304	1,501	2,824	4,086	
MINISTRY OF HOUSING	465	1,880	3,414	4,790	
WALL BRACKETS	—	12,534	17,953	19,829	
TOTAL	6,092	20,866	29,388	34,429	

Projects

A policy of forward planning defines the Directorate's power requirements in the coming years, as well as capabilities in the area of technology to implement new projects. The Directorate has already undertaken studies with consultants and representatives from the Water Directorate and other Ministries to determine Power

and Water installation programmes for the years from 1985 until 1995.

Works completed in 1984, as shown here in Table 11, offer an overview of the Directorate's ongoing efforts to brace the State of Bahrain for future power needs.

TABLE 11

Works completed during 1984 were:

4 — 70 MW GAS TURBINE GENERATORS AT RIFAA II TO COMPLETE THE 6 x 70 MW POWER STATION.

1 — 24 MW GAS TURBINE GENERATOR WITH WASTE HEAT BOILER AT SITRA POWER STATION

1 — AUXILIARY BOILER WITH STEAM RAISING CAPACITY FOR 5 MIGPD DISTILLATE AT SITRA POWER STATION

1 — 220 KV SUBSTATION

7 — 66 KV SUBSTATIONS

44 — 11 KV CIRCUIT BREAKERS INSTALLED TO COMPLETE ALL PRIMARY SUBSTATION 11 KV SWITCHBOARDS

67 KMS — ROUTE LENGTH 66 KV CABLE

DISTRIBUTION CONTROL CENTRE AND VARIOUS SYSTEM CONTROL EXTENSIONS

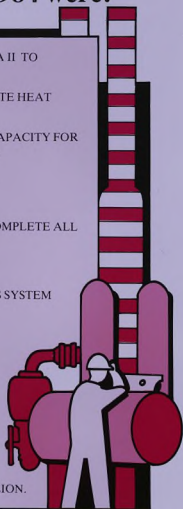
CAREERS DEVELOPMENT CENTRE AT SITRA

GAS PIPELINE REPLACEMENT OF SITRA CHANNEL CROSSING

GAS SCRUBBERS FOR RIFAA I AND II POWER STATION GAS SUPPLIES

VARIOUS GENERATION AND DESALINATION WORKS FOR B.D.F.

TOTAL EXPENDITURE DURING 1984 — BD 51 MILLION.



Manpower Development

The Electricity Directorate, responding to the Government's call for Bahrainisation, continually stresses the development of a competent pool of Bahraini personnel to man the technical operations of plants, stations, and offices. The year 1984 witnessed the steady increase in the number of training projects involving local workers at all levels of positions within the Directorate.

To support the Bahrainisation programme, the Electricity Directorate instituted the construction of the new Careers Development Centre building at Sitra. Installation of educational equipment and management aids, audio-visual tools, and other state-of-the-art training equipment

started in December 1984, and was completed in early 1985.

It is important to note that within the various power stations and departments of the Directorate, Bahrainis have already qualified for, and are now occupying, managerial and technical posts.

The Directorate recognises that 100% self-reliance cannot be realistically achieved in a short time. However, with the full backing of the national Government, and the institution of incentives by the Ministry of Education for engineering and engineering-related studies, the forecast for the local workforce is definitely encouraging.

TABLE 12

Production Department Manpower

	RIFAA POWER STATION						SITRA POWER & WATER STATION							
	CA	IP	B	NB	VAC	VAC%	CA	IP	B	NB	VAC	VAC%	B%	
MANAGEMENT	2	2	1	1	—	—	80	3	3	1	2	—	—	33
ENGINEERS	17	16	2	14	1	6	12	30	17	6	11	13	43	20
TECHNICIANS	34	32	10	22	2	6	23	76	48	20	28	37	26	—
FITTERS	119	66	57	9	53	45	47	259	168	125	43	91	35	48
UNSKILLED	24	4	4	—	20	83	17	46	29	29	—	17	37	63
TOTAL	196	120	74	46	76	39	38	414	263	181	84	149	36	41
	MANAMA POWER STATION						SYSTEM CONTROL							
	CA	IP	B	NB	VAC	VAC%	CA	IP	B	NB	VAC	VAC%	B%	
MANAGEMENT	3	3	1	2	—	—	33	2	2	—	2	—	—	
ENGINEERS	5	2	—	2	3	60	—	13	10	1	9	3	25	8
TECHNICIANS	10	10	6	4	—	—	60	11	10	3	7	1	9	27
FITTERS	107	103	101	2	4	4	94	3	2	—	2	1	33	—
UNSKILLED	18	14	14	—	1	7	98	2	1	1	—	1	50	50
TOTAL	140	132	122	10	8	8	87	31	25	5	20	6	19	18
	PRODUCTION DEPARTMENT													
	CA	IP	B	NB	VAC	VAC%	B%							
MANAGEMENT	10	10	10	3	7	—	—							
ENGINEERS	45	45	45	6	36	20	31							
TECHNICIANS	131	100	39	61	31	24								
FITTERS	485	338	284	54	147	30								
UNSKILLED	85	47	47	—	38	45								
TOTAL	776	540	382	158	236	30								

NOTE: ADMIN. TRAINEES AND LABOURERS NOT INCLUDED MANAGEMENT P6 AND P7 ENGINEERS P4 AND P5 UNSKILLED G2 — G4

KEY: CA — CURRENT APPROVED IP — IN PLACE B — BAHRAINI NB — NON BAHRAINI VAC — VACANCIES

WATER SUPPLY DIRECTORATE



The Water Supply Directorate made full use of modern technology to bring potable water through the taps of more homes in 1984 onwards. This effort was best evidenced by the commissioning of the Reverse Osmosis (RO) Plant at Ra's Abu Jarjur, which is envisioned to effectively help in supplementing the decreasing supply of underground fresh water.

Reverse Osmosis is the most promising breakthrough in the conversion of saline water into drinking water. It has far greater flexibility in siting and operation than the more established multi-stage flash distillation process.

The Ra's Abu Jarjur RO Plant is a major element in the planned seven-fold increase in Bahrain's installed desalination capacity, from 22.75 Ml/day (5mgd) to 113.75 Ml/day (35mgd), to be implemented in the period from mid-1984 to mid-1985.

The commissioning of new units at the Sitra Plant, and the Ra's Abu Jarjur RO Plant has made it possible to divert the supply of blended water to more parts of Manama for the first time.

Planning and Development

Demand has been expected to grow with the general progress of the State of Bahrain, especially in the domestic, commercial, and industrial sectors. In response, the Water Supply Directorate designed a four-year programme of new water supply projects, the third year of which was completed in 1984. And to sustain the momentum, the Directorate has already prepared the major items of the next four-year programme.

Although a great part of the year's development efforts was devoted to the commissioning of the Ra's Abu Jarjur Reverse Osmosis Plant, other projects were implemented with vigour. The commissioning of two new distillers at Sitra by the Electricity Directorate was also a major contribution to the development of

the water supply system. The distillers each have a capacity of 22.75 Ml/day, compared to the 45 Ml/day capacity of the RO Plant.

The introduction of desalinated water into the urban areas of Manama and Muharrag made more water available to a greater number of consumers. However, the risk of over-consumption and needless waste could never be understated, especially as the desalination plants were constructed at enormous expense. For the RO Plant alone, BD15 million was spent in 1984 (out of an expected total of BD42 million), which was just a portion of the BD29.2 million used to finance the headworks and mainlaying, among other projects in 1984.



Economy through Tariffs

Several steps were taken by the Ministry to curb the excessive use and wastage of water. The most significant of these was "economy through tariffs," a system of assigning a rate to be charged for the amount of water used. Water meters were installed, totalling approximately 6,000 in the central areas of Rifaa, A'ali, Isa Town, Nuwaidirat, and Ma'ameer. These meters will indicate how much water has been actually consumed. It is expected that this system will encourage conservation measures by all sectors.

Table 1 underscores the need for consumer economising in the face of expenditure incurred for capital works from 1976 to

1984. Table 2 on the next page shows the progress made in the installation of meters which is expected to be instrumental in the conservation programme.

To stimulate consumer initiative in saving water, the Water Supply Directorate embarked on informative communication campaigns from 1982 to 1983, with the 1984 "Save Water Campaign" serving as the launching pad for a more comprehensive programme in the coming years. The effort involved TV films, pamphlets, and other literature exhorting people to conserve "this precious gift".

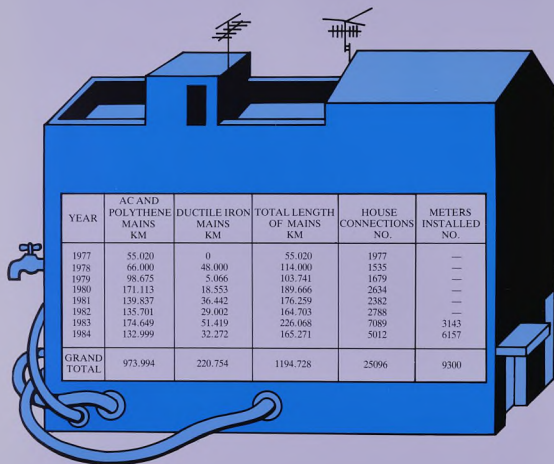
Expenditure on Capital Works

TABLE 1

YEAR	HEADWORKS (i.e. BOREHOLES, PUMPING, STORAGE AND R.O.) BD X MILLION	MAINS BD X MILLION	TOTAL EXPENDITURE BD X MILLION
1976	0.313	1.896	2.209
1977	0.369	2.734	3.103
1978	1.570	6.873	8.443
1979	3.750	3.900	7.650
1980	3.415	6.522	9.937
1981	3.630	6.700	10.330
1982	5.930	7.170	13.100
1983	3.976	7.454	11.430
1984	3.758	8.616	12.374
(EXCL. R.O.)			
SUB-TOTAL NO. 1	26.711	51.865	78.576
1983 R.O. EXPENDITURE	12.175	3.367	15.542
1984	15.041	1.876	16.917
SUB-TOTAL NO. 2	27.216	5.243	29.291
GRAND TOTAL 1976-1984	53.927	57.108	110.035

TABLE 2

Primary and Secondary Distribution and Transmission Mains Laid



YEAR	AC AND POLYTHENE MAINS KM	DUCTILE IRON MAINS KM	TOTAL LENGTH OF MAINS KM	HOUSE CONNECTIONS NO.	METERS INSTALLED NO.
1977	55.020	0	55.020	1977	—
1978	66.000	48.000	114.000	1535	—
1979	98.675	5.066	103.741	1679	—
1980	171.113	18.553	189.666	2634	—
1981	139.837	36.442	176.259	2382	—
1982	135.701	29.002	164.703	2788	—
1983	174.649	51.419	226.068	7089	3143
1984	132.999	32.272	165.271	5012	6157
GRAND TOTAL	973.994	220.754	1194.728	25096	9300

New Projects

The Water Supply Directorate undertook and completed a series of projects envisioned to work together with the Reverse Osmosis Plant as part of the network of efforts to develop better sources of potable water. Among these projects were the completion of the elevated storage tanks at Hidd and Sanabis, civil engineering works for Hamalla "A" groundwater pumping station and at West Rifaa blending station, the trunk main from Ra's Abu Jarjur to West Rifaa, foundation for ground tanks at Madinat Hamad, modifications to the ground tanks at West Rifaa, and strengthening of the distillate main from Sitra to West Rifaa.

Water was supplied to Madinat Hamad for its initial phase, District 1. As the town expands to its four districts, the Directorate

will sustain the delivery of clean tap water to this newest of Government housing projects.

A number of major headworks and mains contracts were awarded, the most important being for the construction of ground storage tanks at Hidd, Sanabis, Musalla, Salmaniya, Sitra and Muharraq blending stations, and for Sitra forwarding station. Contracts were also awarded for the construction of elevated tanks at Budaiya and Janusan, in addition to contracts for support projects.

Water Services

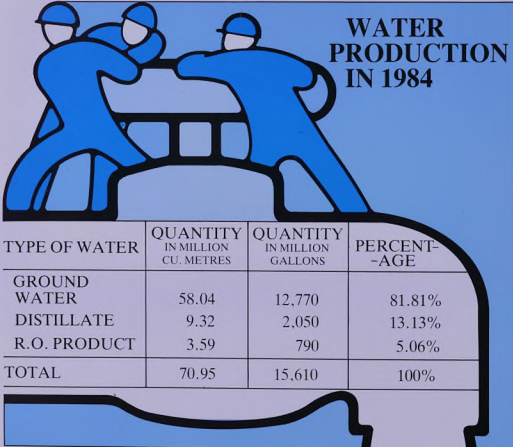
Production

A marked increase in output was posted by the desalination, blending, and pumping stations. The Water Supply Directorate was able to supply a 1984 total of 70.95 million cubic meters (15,610 mg) of water to more parts of Bahrain. This volume represents a 13.7% increase over 1983, which is equivalent to a supply of 489.5 litres or 107.7 gallons per day for each individual.

During 1984, significant improvement in the chlorination of water supply was achieved, the aim being to ensure the sterility of water in supply.

Table 3 presents the water supply produced in 1984 broken down into ground water and fresh water from the desalination plants.

TABLE 3



TYPE OF WATER	QUANTITY IN MILLION CU. METRES	QUANTITY IN MILLION GALLONS	PERCENT-AGE
GROUND WATER	58.04	12,770	81.81%
DISTILLATE	9.32	2,050	13.13%
R.O. PRODUCT	3.59	790	5.06%
TOTAL	70.95	15,610	100%

Distribution

The two general supply areas, rural and urban, are regularly serviced by emergency maintenance gangs for faults and leaks. To facilitate quick response to emergencies on any part of the supply system repair gangs work on 24-hour shifts. These groups are stationed at Isa Town, Rifaa, and Budaiya (for rural areas), and at Manama, Muharraqa, and Al Khamis (for urban areas). Meanwhile, information on consumer emergencies are relayed to the repair gangs by the Complaints Centre.

The responsiveness to emergencies is manifested by the track record of the Water Supply Directorate in 1984 in the field of maintenance as shown here in Table 4.

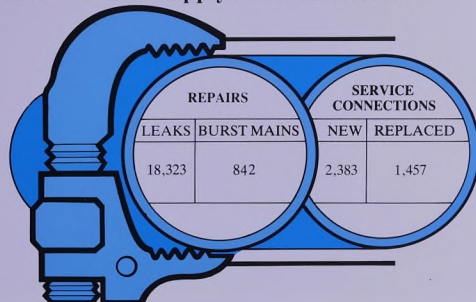
Consumer Services Section continued to respond to the public's water supply needs. A computer link was installed between this section and the Commercial Department. With the increase in water connections, this computer link will help provide

accurate information on any private or public water account, and data on new connections.

Consultants from the Water Research Centre (WRC) in the United Kingdom visited the Island in 1984. With the assistance of the Water Supply Directorate's staff, the WRC engineers conducted studies to determine the level of unaccounted water, and also developed cost-effective methods of controlling losses due to leaks. Further studies were carried on by the Directorate staff, and will be part of an on-going programme.

The cadre of experienced water supply inspectors was briefed about the connection requirements and about the implementation of the Directorate's regulations on plumbing installations.

TABLE 4 Water Supply Maintenance 1984



REPAIRS		SERVICE CONNECTIONS	
LEAKS	BURST MAINS	NEW	REPLACED
18,323	842	2,383	1,457

Mechanical and Electrical Services

The Water Supply Directorate operates a Mechanical and Electrical Services Section mainly to keep stations and plants running at efficient levels.

To handle the increased number of water meters installed, a meter workshop was constructed at Salmabad. Facilities include

equipment for testing and repairing water meters, whether they are bulk meters used by blending stations or small meters at private homes.



Manpower Development

The new Reverse Osmosis Plant at Ra's Abu Jarjur, and the one that will be built soon at Ad Dur, will require approximately two hundred workers to man all aspects of maintenance and operations. With the Government's impetus on conserving national wealth, the need for highly qualified Bahraini manpower to gradually replace expatriates has become more imperative.

Serious efforts have been made, and will continue to be made, to ensure that staff at all levels receive suitable training to improve their skills, professional ability, and on-the-job efficiency.

Recruitment exercises for key technical posts such as mechanical engineers, senior instrument technicians, and other senior staff were implemented.

In-house training in a wide range of subjects was carried out by Power and Water Affairs Training Department. With the help of

BAPCO, the Directorate conducted courses in maintenance, repair, and inspection work.

A number of Water Services Department personnel gained invaluable exposure, knowledge, and experience by working with the UK experts who conducted the study on leak detection. An engineer from the chlorination plant manufacturer carried out maintenance and training in Bahrain. At the end of the training period, the Directorate staff was certified as fully competent to handle maintenance and repairs of chlorination equipment at the blending stations.

Manpower development continued to support the Government's Bahrainisation programme as more and more local personnel were given the opportunity to be trained in the skills required in the various branches of the Directorate.

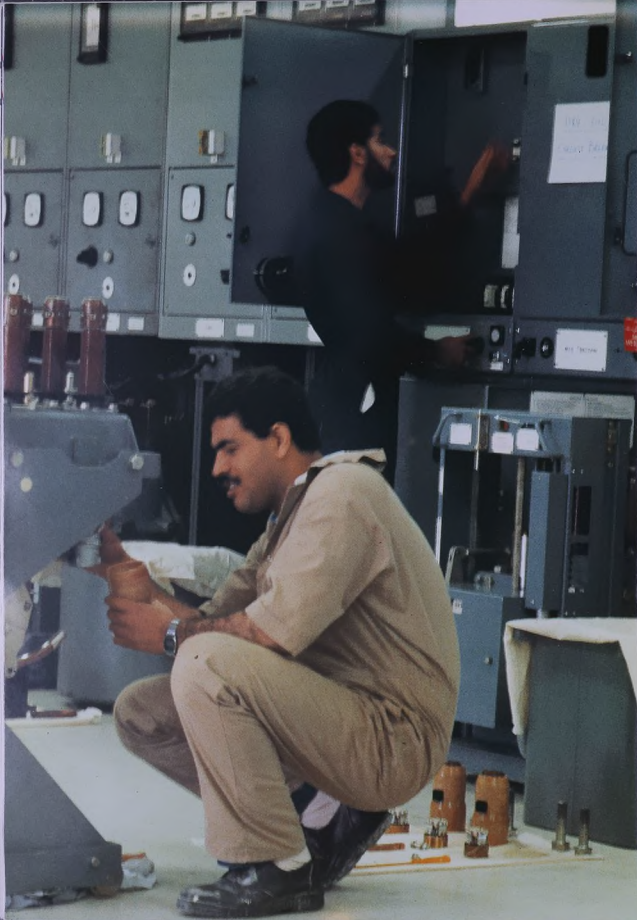
ADMINISTRATION AND FINANCE DIRECTORATE

For the past 3 years, and particularly in 1984, cost-efficiency in operations, and selective Bahrainisation have been the two major thrusts of the Administration and Finance Directorate.

Important steps taken in the drive towards cost-efficiency were the computerisation and integration of the costing system for the whole of Power and Water Affairs. The objective was not only to realise greater savings from day-to-day operations, but

also to provide assistance to managers in controlling expenditures, among other decision-making areas.

The Directorate's continuing objective is to provide consumers with a consistently high standard of service, whether through accurate accounting of their power and water consumption, or in the prompt response to emergencies anywhere within the State of Bahrain.



Accounts and Finance

Computerised Management Information is now produced on a monthly basis to equip decision-makers with precise and up-to-date facts, and to provide better control on expenditures.

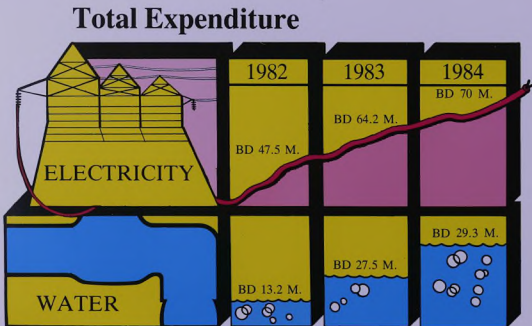
The increase in the number and complexity of power and water projects required proportionately increasing expenditure not only on capital works, but also on manpower and maintenance. Table 1 presents a 3-year overview of expenditure of the Electricity and Water Supply Directorates.

In addition to the BD109 million spent on projects, the annual payroll for Power and Water Affairs employees forms a substantial portion of total expenses.

A completely integrated costing system now operates for the Payroll costs, and this enables accurate costing of individual components to be carried out, highlighting areas where savings and efficiencies can be achieved.

This system allows for the yearly amount of BD15 million for some 2,750 employees to be paid through the bank as part of the total Government payroll.

TABLE 1



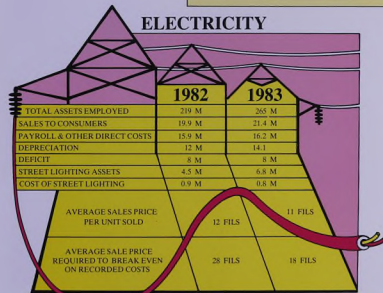
Assets used during the past 3 years progressively increased in cost as more areas in Bahrain were provided with power and desalinated water. Payroll and other direct costs also increased as more qualified personnel joined the workforce during the period.

Sales for both the Electricity Directorate and the Water Supply Directorate increased in 1984. However, while both Directorates showed similar trends in total employed assets and direct costs, they reported contrasting trends in the average sale price needed to break even. In 1984, the

Electricity Directorate needed a sale price of 18 fils to break even (versus 18 fils in 1983 and 28 fils in 1982), registering a levelling off of the sale price and break even ratio. On the other hand, the Water Supply Directorate needed a 795 fils average sale price to break even in 1984 (versus 731 fils in 1983 and 697 fils in 1982), showing an upward trend in the sale price and break even ratio. The Water Supply Directorate's higher figure can be traced to the massive capital outlay used on the Reverse Osmosis Plant at Ra's Abu Jarjur, and the two new distillers at Sitra. See Table 2 for comparative figures.

TABLE 2

WATER		
	1982	1983
TOTAL ASSETS EMPLOYED	57 M.	81 M.
SALES TO CONSUMERS	0.8 M.	0.9 M.
PAYROLL AND OTHER DIRECT COSTS	6 M.	6 M.
DEPRECIATION	3.2 M.	3.8 M.
DEFICIT	8.4 M.	8.9 M.
AVERAGE SALES PRICE PER 1000 IMP. GALS SOLD	58 FILS	66 FILS
AVERAGE SALES PRICE NECESSARY TO BREAK EVEN ON RECORDED COSTS	697 FILS	731 FILS



Innovations in Service

Important changes were instituted in Power and Water Affairs in 1984 to cope with increased workload, as well as to provide better service to all sectors of the public. A major development was the opening of the Commercial Department's new Regional Office in Muharraq Island, which will serve as many as 20,000 consumers within the Muharraq, Hidd, and nearby Village areas. The installation of an on-line IBM terminal complemented the services of the new Regional Office in providing up-to-the-minute information on all accounts. Similar computerised facilities were installed at the King Faisal Road Headquarters and in the Central Market Manama Office.

Modernisation continued with the Mobile Cash Office visiting more and more areas weekly to relieve the main office of mounting workload. New machinery and equipment were brought in to automate the processing of bills, and to speed up the systematic issuance of around 100,000 bills per month.

A new numbering system, assigning a unique number to the name of an occupant of a property as distinct from a number for the property as before, was introduced for more accurate accounting and updating.

TABLE 3

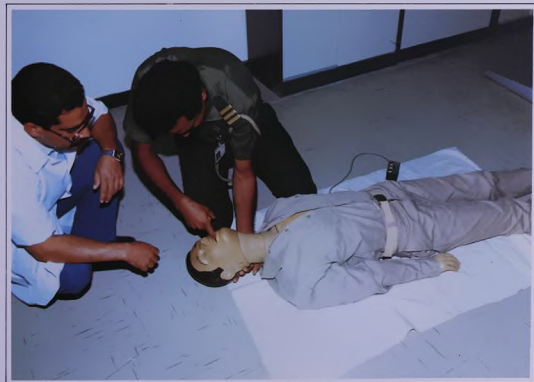
CUSTOMER STATISTICS

	1982	1983	1984
CONSUMER SERVICES :			
NEW CONSUMERS CONNECTED	6,874	6,751	7,800
ADDITIONAL SUPPLIES CONNECTED	1,274	1,176	885

Risk Control

The Risk Control Organisation (RCO) is responsible for ensuring that each plant site, which lies under the jurisdiction of Power and Water Affairs, is secure and safe for all employees. In 1984, the RCO initiated the standardisation of procedures and equipment, especially in the field of fire

engineering and protection in the Electricity Directorate. Life-saving techniques, such as Cardio-Pulmonary Resuscitation (CPR) and advanced first aid, were featured regularly in exercises attended by operatives at all levels.



Manpower Development

The Administration and Finance Directorate recognises the important role that continuous staff development does in creating a proficient workforce on the one hand, and in attaining the organisation's clearly stated objective of Bahrainisation on the other hand.

For the past three years, cautious strides were taken by the Directorate in the Bahrainisation programme in order to

appoint only the most qualified Bahraini professionals to key posts. The year 1984 witnessed tangible results from across the board training, instituted by various components of the Directorate.



Training Centre

The best example of the organisation's on-going commitment toward the achievement of the above stated goals is the new Career Development Centre of Power and Water Affairs at Sitra Industrial Site. Covering approximately 5,500 square metres in area, the Training Centre is equipped with specialised training tools, including sophisticated simulators that

reproduce actual situations, problems and challenges that professionals will encounter in typical daily operations. The Training Centre will help new recruits and trainees, as well as seasoned employees such as technicians and engineers. The facilities can accommodate approximately 200 trainees each year.

Assimilation and Career Development

Following proper screening and aptitude testing, the Directorate recruited a total of 123 trainees in 1984 for Engineering, Technician, Operator, and Fitter stream training courses. Twenty different internal training and development courses were implemented by the instructor staff. In addition to these instructional "clinics", 134 seminar courses were conducted by external sources. A total of 1,170 participants attended the seminars.

The immediate need for skilled personnel was partly fulfilled by the assimilation of 48 trainees, who completed their training programmes. Another 47 were given promotions in recognition of their consistently good performance.

The Directorate has outlined long-term academic training programmes for potential as well as currently employed personnel. Students were enrolled in institutions of higher education both in Bahrain and overseas, with the hope of employing their skills for the increasingly sophisticated demands of Power and Water Affairs.

Employees were also selected to study full-time and part-time at Gulf Polytechnic. So far, a total of 356 Bahrainis were given sponsorship for long-term training.

The bright prospects of the Bahrainisation programme reflects the personal initiative of employees to further their careers. At the end of 1984, 52 Bahrainis, mostly Engineers and technicians, were identified for Career Development Programmes which guarantee specific positions in various line departments. A total of 36 career development plans were implemented, and 12 Bahrainis successfully completed their programmes.

The success of the efforts towards Bahrainisation is now reflected by the tendency of individuals to look at employment within Power and Water Affairs, not just as a source of livelihood, but as a long-term career.

SUMMARY

Throughout Power and Water Affairs, there was a marked increase in the use of advanced technologies in 1984. This has been particularly true for the Electricity Directorate's improvement of electrical efficiency to levels higher than those of the preceding years. This is further reflected by the Water Supply Directorate's commissioning of the Reverse Osmosis Plant at Ra's Abu Jarjur. The bottomline has been the greater distribution of adequate power and water to more homes, industries, and commercial establishments than ever before, to support the economy of the State of Bahrain, and to sustain the improved standard of living of the people.

Technology, however, is but the pillar that props the continuing efforts of the Government and Power and Water Affairs to serve the public. The solid foundation is TALENT: manpower with the skill to maintain the level of performance of complex machinery; and people with the vision to sustain the momentum of the past years' accomplishments.

In the long run, technology and talent will prove to be Bahrain's major resources.



