付録

別添１．要請書
別添２．年負荷曲線
別添３．発電所基礎データ
別添４．需要予測
別添５．発電所位置
別添６．発電コスト
別添７．電力需要と損失の推移
別添８．発電設備容量
別添９．電力消費量
別添 10．収集資料リスト
別添 11．質問状

別添１．要請書

開発調査要請案件調書 (7年10月作成)					
国名	オマーン	公館名	在オマーン大使館	担当書記官名	尾　高
案件名（注１）	和：電力合理化システム需給管理 英（仏・西）：Demand Supply Management (DSM) for Power and Water Sectors				
調査形態（注２）	M/P		調査分野（注３）	公共事業	
実施機関名（注４）	電力・水省				
正式要請書	(有)・無（7年10月入手済・見込み）		TOR	(有)・無（7年10月入手済・見込み）	
先方優先順位	件中　位	貴館優先順位	11件中 1位（注5）	(新規)・継続要請（注6）	

Ⅰ．１．要請案件の背景・目的・内容（調査対象の規模等具体的に記述すること）

オマーンのマスカット（首都）及び地方における電力・水の供給は、国全体の重要課題である。水・電気は、当国で生産される石油・天然ガスを利用し発電され、その余熱及び電力で海水の淡水化が行われているが、その重要な電力・水の需給のロスを軽減する等の合理化を目指すもの。

そのため電力・給水の需要と供給の確保及び運転の信頼性、効率化について日本に技術協力を要請してきた。

２．具体的調査項目（箇条書きで記述すること）（注７）

電力・給水の需要と供給関係を明らかし、能率的かつ有効な給水発電システムを開発する。
電力ピーク時の負荷の改善と負荷の分散
漏電及び漏水の調査
電気給水の運転停止を減少する。
需要と供給から電力、水の料金体系を確立し、収入を増やす。

３．要請に至るまでの経緯　（注８）

昭和６０年８月　バルカ発電・海水淡水化プラントF／S調査
平成　５年６月　バルカ発電・海水淡水化プラント開発調査

（注９）プロファイ者名　　（　　年　　月）

４．我が国・第３国・国際機関の経済技術協力等との関係（要請・実施中、実施済みの案件）（注10）

５．調査対象地域の治安状況

問題なし

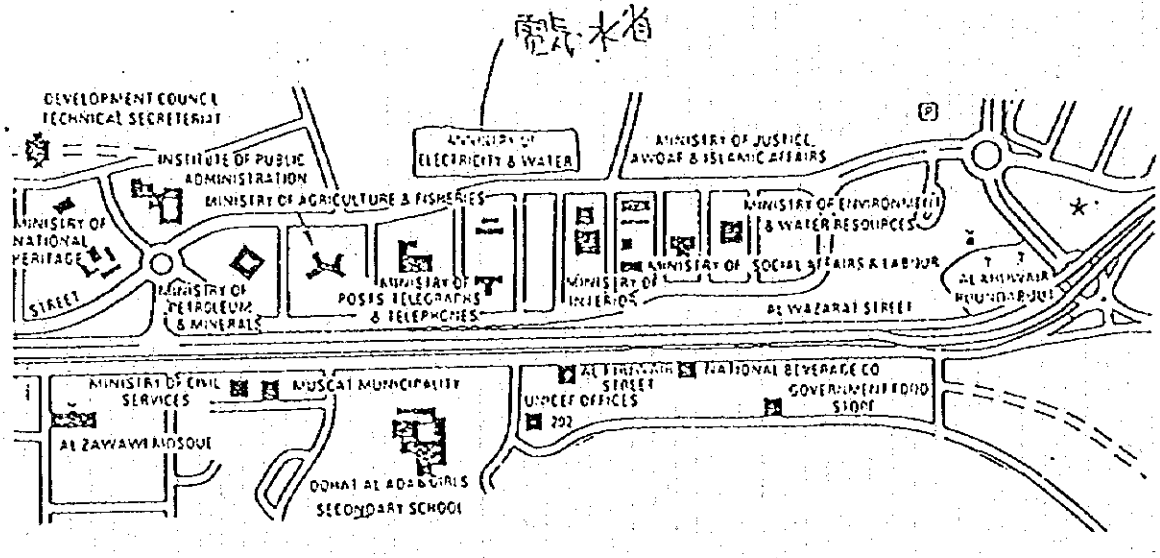
６．事業実施の可能性　（注11）
（特に、D／D、アフターケア調査に関しては必ず記載）
概算事業費：
資金ソース：円借、無償、自己資金、世銀、その他（　　）未定
貴館の評価：
資金手当不明

II. その他関連情報

III. 貸能総合評価・所見 (注12)
(可能な限り貴地ＪＩＣＡ~~、ＯＥＣＦ~~事務所の意見も聴取のこと)

首都のマスカット及びその周辺では地域では、工業化及び人口の増加による電気・水の需要が急増し、慢性的な供給不足が生じている。送電・変電・配電設備による送電損失及び水道網による漏水等を改善、縮小し、需要の季節的、時間的変動に対応できる経済的かつ効率的な需要・供給均衡度システムを開発することにより電気・水の安定供給、信頼性、燃料消費及び電力ピーク時の負担軽減を実現し、ひいては資源の節約を促進し経済効果を高めるもので協力意義の大きい優良案件である。

(調査対象地域略図) 必ず添付のこと (注13)



(T/R)

APPLICATION FOR THE

TECHNICAL CO-OPERATION (DEVELOPMENT STUDY)

BY THE GOVERNMENT OF JAPAN

By the Government of the Sultanate of Oman

for a Development Study on Demand Supply Management (DSM) for Power Sectors (including Tariff Structure)

to the Government of Japan

NOTE: This form was devised for the general guidance of the Government agencies concerned (Japan) in order to facilitate the supply of relevant information and data necessary to afford an adequate appreciation of the nature of the technical co-operation . The careful completion of an application in this form will avoid much reference back and lead to speedier action.

I. Project Digest

(1) Project Title: Demand Supply Management (DSM) for Power and Water Sectors

(2) Location: (Please attach a location map.) Sultanate of Oman

(3) Implementing Agency

(a) Name of the Agency : Ministry of Electricity and Water

(b) Number of the Staff of the Agency (on a category basis)

(c) Budget allocated to the Agency

(d) Organization chart (Please attach a organization map)

(4) Justification of the Project

(a) present condition of the sector The Power and Water Sectors presently have block and flat tariff structures

(b) sectoral development policy of the national/local government

To provide electricity to all villages in Oman by the year 2000.
To provide piped water to villages over 500 persons in Oman by the year 2005.

(c) problems to the solved in the sector

- improvement of load factor and reliability
- reducing losses
- reducing outages
- increasing revenue

(d) outline of the Project

The project will aim to reduce peak load and to distribute it over a time period

(e) purpose (short-term objective) of the Project

To balance the demand and supply

(f) goal (long-term objective) of the Project

To improve the efficiency of the system, power utilization, load factor; to reduce losses;
To implement a tariff structure relating to maximum demand and energy consumed.

(g) prospective beneficiaries

The consumers of electricity and water and the Government of Oman

(h) the Project's priority in the National Development Plan/Public Investment Program

The highest priority is to operate on efficient system which relates to maximum demand and energy consumed

(5) Desirable or scheduled time of commencement of the Project

As soon as possible

(6) Expected funding source and/or assistance (including external origin)

Not Applicable

(7) Other relevant Projects, if any.

Not Applicable

II. Terms of Reference of the proposed Study

Will be provided on approval

(1) Necessity/Justification of the Studies

To study the demand supply management for efficient and economic operation of generation, transmission and distribution system.

(2) Necessity/Justification of the Japanese Technical Cooperation

To transfer necessary expertise and relevant technology to the Government of Oman.

(3) Objectives of the Study

To optimize demand supply management of the power and water sectors

(4) Area to be covered by the Study

Sultanate of Oman

(5) Scope of the Study

To assist and advice on the factors that would improve the efficient management of production, transmission and distribution of power and water to the consumers. To suggest improvement to optimize demand supply management. To advice on methodology to increase revenue with minimised burdern to consumers.

(6) Study Schedule

Twelve months to include winter and summer cycle

(7) Expected Major Outputs of the Study

1) Operation schedules of production machines
2) Procedures for load dispatch
3) Reduction of revenue losses
4) Restructing tariff to maximise revenue with minimum burden on consumers

(8) Request of the Study to other donor agencies, if any

Not Applicable

(9) Other relevant information, if any

Not Applicable

III. Facilities and Information for the Study Team, etc.

(1) Assignment of counterpart personnel of the implementing agency for the Study (number, academic background, etc.)

Directorate of Planning and Statistics - 4 persons - Ph.D., B.Sc.

(2) Available data, information, documents, maps etc. related to the Study (Please attache the list)

1993 annual statistics for electricity and water.
Single line diagrams and maps of all areas are available

(3) Information on the security conditions in the Study Area

Not Applicable

IV. Global Issues (Environment, Women In Development, Poverty, etc.)

Not Applicable

(1) Environmental components (such as pollution control, water supply, sewage, environmental management, forestry, bio-diversity-diversity) of the Project, if any

Not Applicable

(2) Anticipated environmental impacts (both natural and social) by the Project, if any

Not Applicable

(3) Woman as main beneficiaries or not

Not Applicable

(4) Project components which require special considerations for women (such as gender difference, women specific role, women's participation), if any

Not Applicable

(5) Anticipated impacts on women caused by the Project, if any

Not Applicable

(6) Poverty reduction components of the Project, if any

Not Applicable

(7) Any constraints against the low income people caused by the Project

V. Undertakings of the Government of the Sultanate of Oman

In order to facilitate a smooth and efficient conduct of the Study, the Government of the Sultanate of Oman shall take necessary measures:

(1) to secure the safety of the Study team.

(2) to permit the members of the Study team to enter, leave and sojourn in the Sultanate of Oman in connection with their assignment therein, and exempt them from alien registration requirement and consular fees.

(3) to exempt the Study team from taxes, duties and any other charges on equipment, machinery and other materials brought into and out of the Sultanate of Oman for the conduct of the Study.

(4) To exempt the Study team from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of the Study team for their services in connection with the implementation of the Study.

(5) to provide necessary facilities to the Study team for remittance as well as utilization of the funds introduced in the Sultanate of Oman from Japan in connection with the implementation of the Study.

(6) to secure permission for entry into private properties or restricted areas for the conduct of Study.

(7) to secure permission for the Study to take all data, documents and necessary materials related to the Study out of the Sultanate of Oman to Japan.

(8) to provide medical services as needed. Its expenses will be chargeable to members of the Study team.

VI. The Government of the Sultanate of Oman shall bear claims, if any arises against member(s) of the Japanese Study team resulting from, occurring in the course of or

otherwise connected with the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or wilful misconduct on the part of the member of the Study team.

VII. (The Implementing agency) shall act as counterpart agency to the Japanese Study team and also as coordinating body in relation with other governmental and non-governmental organization concerned for the smooth implementation of the Study.

The Government of the Sultanate of Oman assured that the matters referred in this form will be ensured for a smooth conduct of the Development Study by the Japanese Study Team.

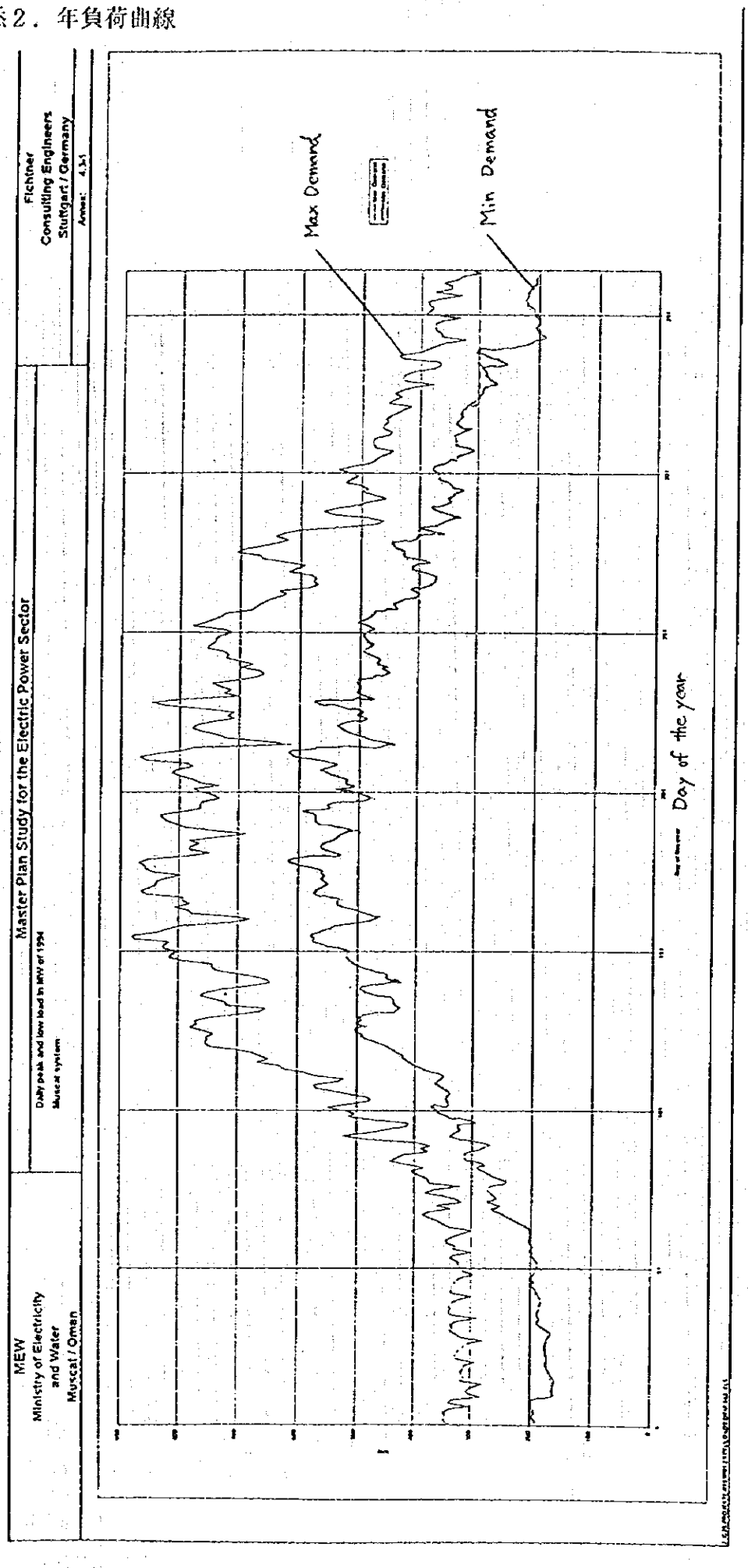
Signed: _____

Title: Acting Director of H.E
The Minister Office

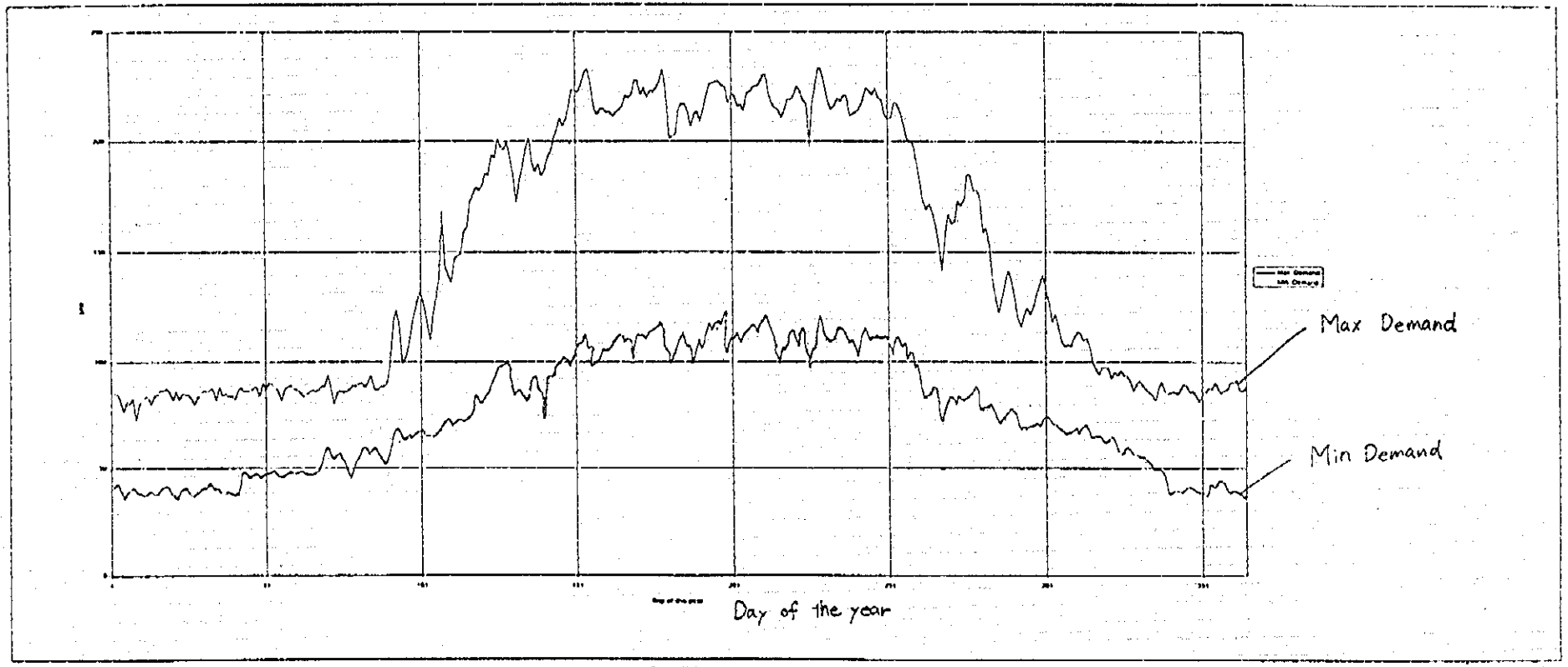
On behalf of the Government of _____

Date: _____

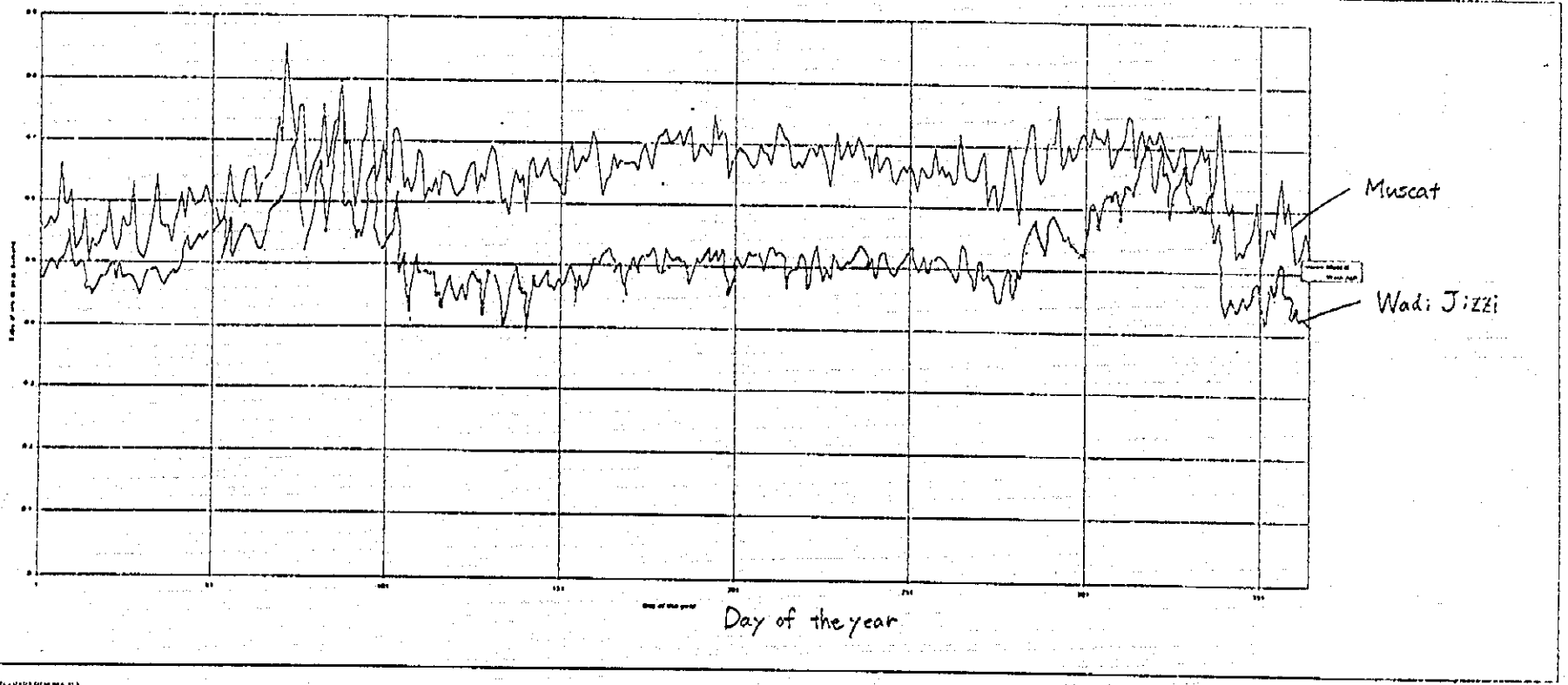
別添２．年負荷曲線


MEW
Ministry of Electricity and Water
Muscat / Oman
Master Plan Study for the Electric Power Sector
Daily peak and low load in MW of 1994
Muscat system
Fichtner
Consulting Engineers
Stuttgart / Germany
Annex: 4.3-1
Max Demand
Min Demand
Day of the year

MEW Ministry of Electricity and Water Muscat / Oman	Master Plan Study for the Electric Power Sector Daily peak and low load in MW of 1994 Wadi Jizzi System	Fichtner Consulting Engineers Stuttgart / Germany Annex: 4.3-2



MEW Ministry of Electricity and Water Muscat / Oman	Master Plan Study for the Electric Power Sector Daily load variation: Ratio of low load to peak load Muscat system and Wadi Jizzi system	Fichtner Consulting Engineers Stuttgart / Germany Annex: 4.3-5



MEW Ministry of Electricity and Water Muscat / Oman	Master Plan Study for the Electric Power Sector Rusail Power Station Main technical and operational data	Fichtner Consulting Engineers Stuttgart / Germany Annex: 2.2.2-1

Main technical data

Unit	GT-1	GT-2	GT-3	GT-4	GT-5	GT-6
Manufacturer	J.B.E.	J.B.E.	J.B.E.	G.E.	G.E.	G.E.
Rating in MW at 50 °C	83.3	83.3	83.3	83.5	83.5	83.5
Date of Commissioning	1984	1984	1984	1987	1987	1987
Running hours until 10.95	65,635	64,089	71,474	50,108	52,897	51,943
Number of starts until 10.95	304	264	275	189	147	136
Reliability (1993 figures)	99.47%	99.93%	100.00%	100.00%	99.76%	99.99%

Main operational data

	1990	1991	1992	1993	1994
Generation in MWh	2,257,604	2,302,441	2,419,240	2,559,667	2,595,303
Station consumption & losses in MWh	20,195	22,290	21,936	25,261	27,635
Export in MWh	2,237,409	2,280,151	2,397,304	2,534,406	2,567,668
Fuel gas consumption in 1000 SCM	757,221	778,719	812,092	859,414	898,016
Specific fuel consumption in SCM/MWh	335	338	336	336	346
Specific fuel costs in BZ/kWh	9.507	9.639	9.540	9.552	9.983
Specific manpower costs in BZ/kWh	0.263	0.258	0.243	0.232	
Total costs in BZ/kWh	11.674	11.521	11.553	11.619	
Availability	82.08	83.53	87.31	86.9	
Power factor	0.84	0.83	0.83	0.825	

MEW Ministry of Electricity and Water Muscat / Oman	Master Plan Study for the Electric Power Sector Ghubrah power station Main technical and operational data	Fichtner Consulting Engineers Stuttgart / Germany Annex: 2.2.2-2

Main technical data

Unit	GT-1	GT-2	GT-3	GT-4	GT-5	GT-6	GT-7	GT-8	GT-9	GT-10	GT-11	GT-12	GT-13
Manufacturer	Alsthom	Alsthom	Alsthom	Alsthom	Alsthom	Alsthom	Alsthom	Alsthom	Alsthom	G.E.	G.E.		
Type	Frame 5	Frame 5	Frame 5	Frame 5	Frame 5	Frame 5	Frame 5	Frame 5	Frame 5	Frame 6	Frame 6	Frame 9	Frame 9
Rating in MW at 50 °C	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	27	27	95	95
Date of Commissioning	1976	1976	1976	1976	1976	1976	1976	1976	1976	1983	1983	1995	1995
Running hours until 10.95	111,643	107,485	117,135	71,251	71,453	73,129	71,776	72,863	73,323	63,705	57,514	3,921	3,603
Number of starts until 10.95	995	996	920	1184	1325	1277	1228	1245	1139	1225	1131	66	42
Reliability (10.1995 figures)	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	99.91%	98.39%	100.00%	100.00%	99.91%

Unit	ST-1	ST-2	ST-3	ST-4	ST-5
Manufacturer	BBC	BBC	BBC	BBC	ABB
Rating in MW at 50 °C	8.5	8.5	8.5	50	30
Date of Commissioning	1976	1976	1976	1977	1992
Running hours until 10.95	130,607	143,756	142,971	129,325	21,783
Number of starts until 10.95					
Reliability (10.1995 figures)		100.00%	100.00%	100.00%	100.00%

ST-4
20
1994

Main operational data - October 1995

Total Generation in MWh	215,470
Plant Consumption in MWh	15,295
Energy Export in MWh	200,175
Fuel gas consumption in 1000 SCM	64,298

MEW Ministry of Electricity and Water Muscat / Oman	Master Plan Study for the Electric Power Sector Wadi Jizzi Power Station Main technical and operational data	Fichtner Consulting Engineers Stuttgart / Germany Annex: 2.2.2-3

Main technical data

Unit	GT-1	GT-2	GT-3	GT-4	GT-5	GT-6	GT-7	GT-8	GT-9	GT-10
Manufacturer	G.E.	G.E.	G.E.	Thomassen	Thomassen	Alsthom	Alsthom	Thomassen	Thomassen	Thomassen
Type	Frame 5	Frame 5	Frame 5	Frame 6	Frame6	Frame 6	Frame 6	Frame 6	Frame 6	Frame 6
Rating in MW at 50 °C	17.79	17.79	17.79	27.9	27.9	28	28	28	29.55	29.55
Date of Commissioning	1982	1982	1982	1985	1985	1987	1987	1990	1993	1994
Running hours until 10.95	69,199	59,863	39,498	43,914	49,400	46,424	42,104	24,583	9,766	1,468
Number of starts until 10.95	743	714	787	395	506	537	553	246	110	33
Reliability (1994 figures)	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	92.31%	85.24%	74.81%

Main operational data - October 1995

	GT-1	GT-2	GT-3	GT-4	GT-5	GT-6	GT-7	GT-8	GT-9	GT-10
Generation in MWh	85,710	77,794	48,397	132,981	101,933	113,661	109,026	112,859	106,317	47,072
Fuel gas consumption in 1000 SCM	33,926	30,934	19,380	48,445	36,287	41,242	40,686	39,650	36,985	16,762
Specific fuel consumption in SCM/MWh	396	398	400	364	356	363	373	351	348	356

Power factor at peak load in 8 August 1995: 0.82

MEW Ministry of Electricity and Water Muscat / Oman	**Master Plan Study for the Electric Power Sector** Power demand and load forecast Region 1: Capital area and surroundings, including South Batinah Scenario case: medium / most realistic	Fichtner Consulting Engineers Stuttgart / Germany Annex: 4.5 - 1

PRESENT SITUATION

Total consumption of Region

	MWh	growth rate
1990	2,397,368	
1991	2,426,385	1.2%
1992	2,666,611	9.9%
1993	3,038,476	13.9%
1994	3,179,293	4.6%
1995	3,314,435	4.3%
		6.7%

FUTURE DEVELOPMENT OF DOMESTIC SECTOR

1) Capital Area: Muscat, Qurum, Muttrah, Seeb, Rusl.
2) Surroundings of capital area, incl. South Batinah

Parameters		1)	2)
Present Consumption in kWh/hh		17,924	9,406
Saturation Level of Consumption in kWh/hh		17,924	12,000
Expected consumption growth rate of households electrified in 1995			
- from 1996 to 2000		0.0%	2.0%
- from 2001 to 2005		0.0%	1.5%
- from 2006 to 2010		0.0%	1.0%
- from 2011 to 2015		0.0%	0.0%
Number of households electrified in newly electrified villages	1996	0	2,000
	1997	0	1,000
	1998	0	1,000
	1999	0	500
	2000	0	500
Average annual consumption per household of newly electrified villages in kWh/a		6,000	6,000
Expected consumption growth rate of newly electrified households.			
- first five years		5.0%	5.0%
- second five years		4.0%	4.0%
- third five years		3.0%	3.0%
- thereafter		2.0%	2.0%
Population induced growth of consumption			
- from 1996 to 2000		5.0%	3.5%
- from 2001 to 2005		4.0%	3.5%
- from 2006 to 2015		3.0%	3.0%

FUTURE DEVELOPMENT OF NON-DOMESTIC SECTORS

Service improvement factor, Governmental (total Region)	
- 1996 to 2005	0.90
- after 2005	0.90
Service improvement factor, Industry and Commerce (total Region)	
- 1996 to 2005	1.00
- after 2005	0.90
Other consumption alignment	1.0%
Consumption growth rate industrial estate	3.0%

Load factors	1995	2000	2005	2010	2015
Domestic	0.50	0.51	0.51	0.52	0.52
Industrial & Commercial	0.50	0.51	0.51	0.52	0.52
Government	0.50	0.51	0.51	0.52	0.52
Other	0.50	0.51	0.51	0.52	0.52
- Rusayl	0.46	0.46	0.46	0.46	[illegible]

DEVELOPMENT OF CONSUMPTION (in MWh)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Domestic consumption											
Capital area											
- electrified in 1995	1,430,160	1,501,669	1,576,773	1,655,612	1,735,082	1,814,895	1,894,751	1,974,330	2,053,303	2,131,329	2,208,057
- electrified in 1996 to 2000		0	0	0	0	0	0	0	0	0	0
Subtotal of Capital area in MWh	1,430,160	1,501,669	1,576,773	1,655,612	1,735,082	1,814,895	1,894,751	1,974,330	2,053,303	2,131,329	2,208,057
Surroundings of capital area											
- electrified in 1995	519,172	548,090	578,618	610,848	644,872	680,124	716,599	754,288	793,179	833,255	873,648
- electrified in 1996 to 2000		6,210	16,068	23,948	30,989	37,073	41,691	45,284	48,858	52,614	56,495
Subtotal of surroundings in MWh	519,172	554,300	594,687	634,796	675,860	717,197	758,290	799,572	842,038	885,869	930,143
Subtotal of domestic cons. in MWh	1,949,352	2,055,969	2,171,460	2,290,408	2,410,942	2,532,092	2,653,240	2,773,902	2,895,341	3,017,198	3,138,200
Industrial and commercial consumption	403,399	423,569	444,747	466,985	489,400	511,912	534,211	556,199	577,780	598,857	619,338
Consumption of government entities	920,393	961,811	1,005,092	1,050,321	1,095,695	1,141,057	1,186,243	1,231,083	1,275,402	1,319,021	1,361,757
Other consumption	41,291	43,766	46,395	49,176	52,031	54,944	57,911	60,923	63,969	67,039	70,125
Industrial estates / industrial projects											
- Rusayl		50,000	100,000	150,000	200,000	300,000	400,000	500,000	600,000	618,000	636,540
Total annual consumption in MWh	3,314,435	3,535,137	3,767,694	4,006,892	4,248,068	4,540,008	4,831,608	5,172,107	5,412,492	5,620,115	5,825,958
Annual growth rate		6.7%	6.6%	6.3%	6.0%	6.9%	6.4%	6.0%	5.7%	3.8%	3.7%
System losses (of energy sent out)	17.26%	17.26%	17.26%	16.00%	15.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%
Total sent out energy in MWh	4,006,694	4,273,706	4,554,649	4,770,110	4,997,727	5,279,077	5,616,146	5,955,939	6,293,595	6,535,017	6,774,370
Total load factor	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Peak load sent out in MW	923	967	1,044	1,090	1,139	1,202	1,279	1,355	1,432	1,484	1,536

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Domestic consumption										
Capital area										
- electrified in 1995	2,283,131	2,356,191	2,426,877	2,499,683	2,574,673	2,651,914	2,731,471	2,813,415	2,897,818	2,984,752
- electrified in 1996 to 2000	0	0	0	0	0	0	0	0	0	0
Subtotal of Capital area in MWh	2,283,131	2,356,191	2,426,877	2,499,683	2,574,673	2,651,914	2,731,471	2,813,415	2,897,818	2,984,752
Surroundings of capital area										
- electrified in 1995	914,210	954,786	995,213	1,035,320	1,074,911	1,113,801	1,151,804	1,188,731	1,224,393	1,261,124
- electrified in 1996 to 2000	60,488	64,575	68,739	72,960	77,290	81,718	86,233	90,819	95,540	100,431
Subtotal of surroundings in MWh	974,698	1,019,362	1,063,952	1,108,280	1,152,201	1,195,519	1,238,037	1,279,550	1,319,933	1,361,555
Subtotal of domestic cons. in MWh	3,257,829	3,375,553	3,490,829	3,607,963	3,726,874	3,847,433	3,969,508	4,092,965	4,217,751	4,346,307
Industrial and commercial consumption	639,132	658,153	676,318	694,782	713,541	732,606	752,592	772,912	793,761	815,213
Consumption of government entities	1,403,427	1,443,645	1,482,629	1,522,865	1,563,963	1,606,210	1,649,578	1,694,117	1,739,858	1,786,834
Other consumption	73,209	76,283	79,335	82,508	85,808	89,241	92,810	96,523	100,384	104,399
Industrial estates / industrial projects										
- Rusayl	655,636	675,305	695,564	716,431	737,924	760,062	782,864	806,350	830,540	855,457
Total annual consumption in MWh	6,029,232	6,229,139	6,424,875	6,624,549	6,828,130	7,035,752	7,247,352	7,462,866	7,682,313	7,908,209
Annual growth rate	3.5%	3.3%	3.1%	3.1%	3.1%	3.0%	3.0%	3.0%	2.9%	2.9%
System losses (of energy sent out)	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%
Total sent out energy in MWh	7,010,735	7,243,185	7,470,785	7,702,964	7,939,686	8,181,107	8,427,153	8,677,751	8,932,922	9,195,597
Total load factor	0.50	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51
Peak load sent out in MW	1,588	1,636	1,665	1,734	1,784	1,835	1,887	1,940	1,994	2,049

MEW Ministry of Electricity and Water Muscat / Oman	Master Plan Study for the Electric Power Sector Power demand and load forecast Region 1: Capital area and surroundings, including South Batinah Scenario case: low / pessimistic	Fichtner Consulting Engineers Stuttgart / Germany Annex: 4.5 - 9

PRESENT SITUATION

Total consumption of Region

	MWh	growth rate
1990	2,397,368	
1991	2,426,385	1.2%
1992	2,666,611	9.9%
1993	3,038,476	13.9%
1994	3,179,293	4.6%
1995	3,314,435	4.3%
		6.7%

FUTURE DEVELOPMENT OF DOMESTIC SECTOR

1) Capital Area: Muscat, Ourum, Mutrah, Seeb, Ruwi
2) Surroundings of capital area, incl. South Batinah

Parameters		1)	2)
Present Consumption in MWh/yr/h		17,924	9,406
Saturation Level of Consumption in MWh/yr/h		17,924	11,000
Expected consumption growth rate			
of households electrified in 1995			
- from 1996 to 2000		0.0%	1.5%
- from 2001 to 2005		0.0%	1.0%
- from 2006 to 2010		0.0%	0.3%
- from 2011 to 2015		0.0%	0.0%
number of households electrified			
in newly electrified villages	1996	0	1,000
	1997	0	1,000
	1998	0	1,000
	1999	0	1,000
	2000	0	1,000
Average annual consumption per household			
of newly electrified villages in kWh/a		5,500	5,500
Expected consumption growth rate			
of newly electrified households			
- first five years		4.0%	4.0%
- second five years		3.0%	3.0%
- third five years		2.0%	2.0%
- thereafter		1.0%	1.0%
Population induced growth of consumption			
- from 1996 to 2000		4.5%	3.0%
- from 2001 to 2005		3.5%	3.0%
- from 2006 to 2015		2.5%	2.5%

FUTURE DEVELOPMENT OF NON-DOMESTIC SECTORS

Service improvement factor, Governmental (total Region)	
- 1996 to 2005	0.80
- after 2005	0.70
Service improvement factor, Industry and Commerce (total Region)	
- 1996 to 2005	0.90
- after 2005	0.70
Other consumption alignment	1.0%
Consumption growth rate industrial estate	7.0%

Load factors	1995	2000	2005	2010	2015
Domestic	0.50	0.51	0.51	0.52	0.52
Industrial & Commercial	0.50	0.51	0.51	0.52	0.52
Government	0.50	0.51	0.51	0.52	0.52
Other	0.50	0.51	0.51	0.52	0.52
- Rusayl	0.46	0.46	0.46	0.46	0.46

DEVELOPMENT OF CONSUMPTION (in MWh)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Domestic consumption																					
Capital area																					
- electrified in 1995	1,430,160	1,494,538	1,561,792	1,632,073	1,702,252	1,772,044	1,841,154	1,909,277	1,976,102	2,041,313	2,104,594	2,165,627	2,224,099	2,279,701	2,336,694	2,395,111	2,454,989	2,516,364	2,579,273	2,643,755	2,709,848
- electrified in 1996 to 2000		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal of Capital area in MWh	1,430,160	1,494,538	1,561,792	1,632,073	1,702,252	1,772,044	1,841,154	1,909,277	1,976,102	2,041,313	2,104,594	2,165,627	2,224,099	2,279,701	2,336,694	2,395,111	2,454,989	2,516,364	2,579,273	2,643,755	2,709,848
Surroundings of capital area																					
- electrified in 1995	519,172	542,766	567,437	593,227	620,169	647,736	675,844	704,472	733,566	763,152	792,037	820,076	847,103	872,952	897,460	922,104	946,858	971,694	996,584	1,021,499	1,047,036
- electrified in 1996 to 2000		2,833	8,752	15,265	22,406	30,209	38,426	37,797	40,249	42,778	45,334	47,903	50,470	53,020	55,536	58,058	60,576	63,060	65,538	68,028	70,508
Subtotal of surroundings in MWh	519,172	545,601	576,190	608,493	642,595	677,947	714,270	742,269	773,837	805,930	837,370	867,979	897,573	925,971	952,996	980,162	1,007,434	1,034,774	1,062,142	1,089,526	1,117,544
Subtotal of domestic cons. in MWh	1,949,332	2,040,139	2,137,982	2,240,566	2,344,847	2,449,992	2,552,424	2,651,546	2,749,939	2,847,243	2,941,964	3,033,605	3,121,672	3,205,673	3,289,690	3,375,273	3,462,423	3,551,138	3,641,415	3,733,281	3,827,392
Industrial and commercial consumption	403,399	419,737	436,736	454,424	472,010	489,427	506,224	522,332	537,689	552,239	565,934	578,736	590,611	601,538	612,365	623,082	633,966	645,080	656,369	667,856	679,543
Consumption of government entities	920,393	953,527	987,854	1,023,417	1,058,622	1,093,345	1,127,031	1,159,557	1,190,807	1,220,673	1,249,053	1,275,856	1,301,005	1,324,425	1,347,032	1,371,521	1,395,572	1,419,944	1,444,793	1,470,077	1,495,803
Other consumption	41,251	43,562	45,956	48,486	51,055	53,659	56,288	58,934	61,586	64,234	66,868	69,476	72,046	74,566	77,178	79,879	82,675	85,568	88,563	91,663	94,871
Industrial estates / industrial projects																					
Rusayl		50,000	100,000	150,000	200,000	300,000	400,000	500,000	600,000	612,000	624,240	636,725	649,459	662,448	675,697	689,211	702,996	717,056	731,397	746,025	760,945
Total annual consumption in MWh	3,314,435	3,506,965	3,708,530	3,916,892	4,126,535	4,366,423	4,641,968	4,892,370	5,140,021	5,296,389	5,446,060	5,594,400	5,734,794	5,866,650	6,002,862	6,138,966	6,277,602	6,418,786	6,562,537	6,708,901	6,858,595
Annual growth rate		5.8%	5.7%	5.6%	5.4%	6.3%	6.8%	5.4%	5.1%	3.0%	2.9%	2.7%	2.5%	2.3%	2.3%	2.3%	2.3%	2.3%	2.2%	2.2%	2.2%
System losses (of energy sent out)	17.26%	17.26%	17.26%	16.00%	15.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%
Total sent out energy in MWh	4,006,694	4,239,648	4,483,524	4,662,966	4,854,747	5,100,492	5,397,637	5,686,802	5,976,769	6,158,591	6,334,953	6,505,116	6,668,365	6,824,012	6,980,072	7,138,333	7,299,537	7,463,705	7,630,857	7,801,048	7,975,064
Total load factor	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51
Peak load sent out in MW	923	974	1,028	1,066	1,107	1,161	1,229	1,295	1,361	1,400	1,437	1,473	1,507	1,540	1,572	1,605	1,638	1,672	1,707	1,742	1,778

MEW Ministry of Electricity and Water Muscat / Oman	Master Plan Study for the Electric Power Sector Power demand and load forecast Region 1: Capital area and surroundings, including South Batinah Scenario case: high / optimistic	Fichtner Consulting Engineers Stuttgart / Germany Annex: 4.5 - 17

PRESENT SITUATION

Total consumption of Region

	MWh	growth rate
1990	2,397,368	
1991	2,426,365	1.2%
1992	2,666,611	9.9%
1993	3,038,476	13.9%
1994	3,179,293	4.6%
1995	3,314,435	4.3%
		6.7%

FUTURE DEVELOPMENT OF DOMESTIC SECTOR

1) Capital Area: Muscat, Qurum, Mutrah, Seeb, Ruwi
2) Surroundings of capital area, incl. South Batinah

Parameters		1)	2)
Present Consumption in MWh/hh		17,924	9,406
Saturation Level of Consumption in MWh/hh		17,924	13,000
Expected consumption growth rate			
of households electrified in 1995			
- from 1996 to 2000		0.0%	2.5%
- from 2001 to 2005		0.0%	2.0%
- from 2006 to 2010		0.0%	1.0%
- from 2011 to 2015		0.0%	0.0%
Number of households electrified			
in newly electrified villages	1996	0	2,000
	1997	0	1,500
	1998	0	1,000
	1999	0	500
	2000	0	0
Average annual consumption per household			
of newly electrified villages in MWh/a		6,500	6,000
Expected consumption growth rate			
of newly electrified households			
- first five years		6.0%	6.0%
- second five years		5.0%	5.0%
- third five years		3.5%	3.5%
- thereafter		0.0%	0.0%
Population induced growth of consumption			
- from 1996 to 2000		5.5%	4.0%
- from 2001 to 2005		4.5%	4.0%
- from 2006 to 2015		3.5%	3.5%

FUTURE DEVELOPMENT OF NON-DOMESTIC SECTORS

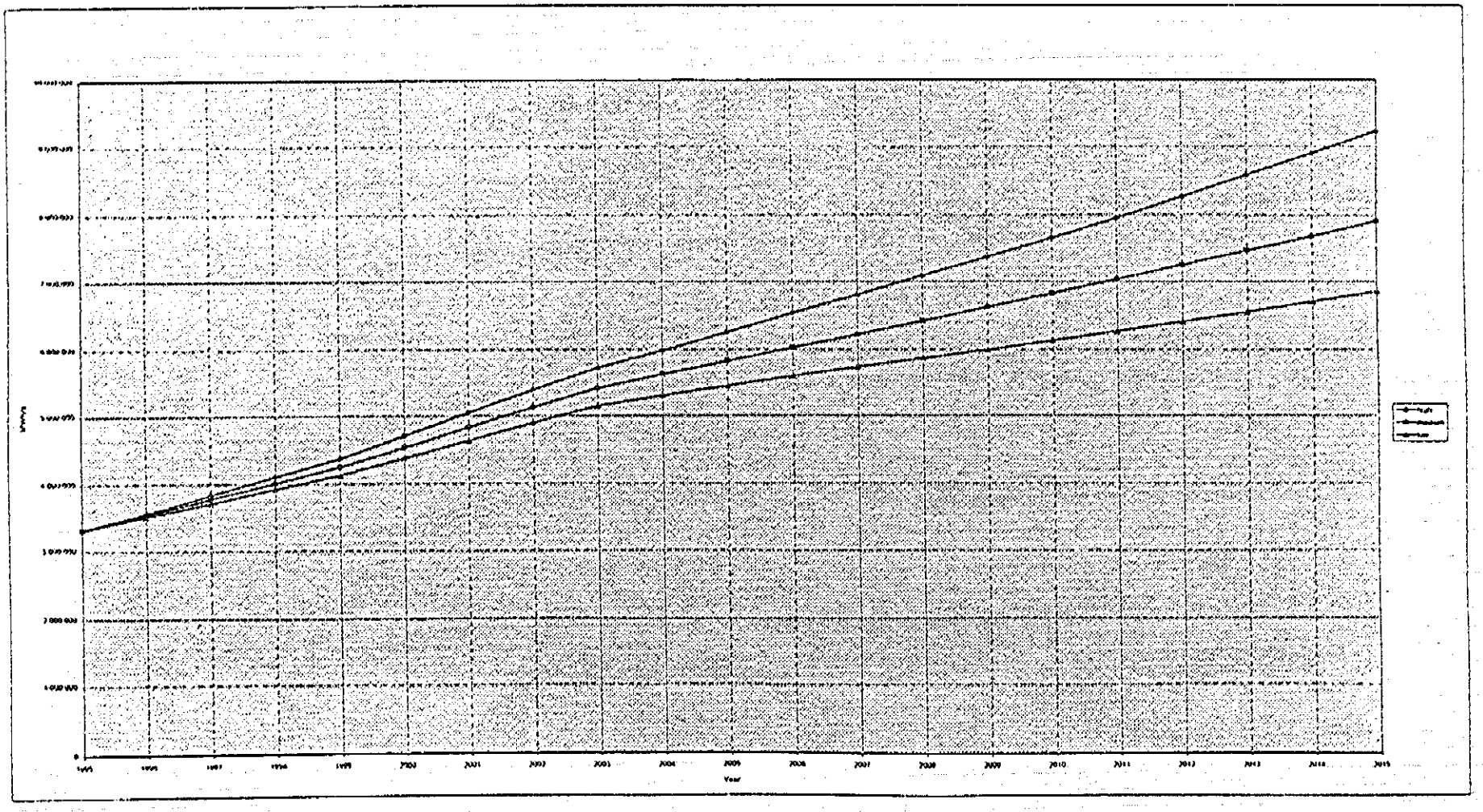
Service improvement factor, Governmental (total Region)	
- 1996 to 2005	1.00
- after 2005	1.20
Service improvement factor, Industry and Commerce (total Region)	
- 1996 to 2005	1.10
- after 2005	1.10
Other consumption alignment	1.0%
Consumption growth rate industrial estate	4.0%

Load factors	1995	2000	2005	2010	2015
Domestic	0.50	0.51	0.51	0.52	0.52
Industrial & Commercial	0.50	0.51	0.51	0.52	0.52
Government	0.50	0.51	0.51	0.52	0.52
Other	0.50	0.51	0.51	0.52	0.52
- Ruwi	0.46	0.46	0.46	0.46	0.46

DEVELOPMENT OF CONSUMPTION (in MWh)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Domestic consumption																					
Capital area																					
- electrified in 1995	1,430,160	1,508,640	1,591,626	1,679,377	1,766,383	1,856,571	1,949,641	2,041,274	2,133,131	2,224,856	2,316,075	2,406,402	2,495,439	2,582,779	2,673,177	2,766,736	2,863,574	2,963,799	3,067,532	3,174,895	3,286,017
- electrified in 1996 to 2000		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal of Capital area in MWh	1,430,160	1,508,640	1,591,626	1,679,377	1,766,383	1,856,571	1,949,641	2,041,274	2,133,131	2,224,856	2,316,075	2,406,402	2,495,439	2,582,779	2,673,177	2,766,736	2,863,574	2,963,799	3,067,532	3,174,895	3,286,017
Surroundings of capital area																					
- electrified in 1995	519,172	553,457	589,964	628,902	670,409	713,959	759,595	807,359	857,286	909,409	961,884	1,014,410	1,066,870	1,118,331	1,169,048	1,219,644	1,269,906	1,319,610	1,368,528	1,416,426	1,466,001
- electrified in 1996 to 2000		6,760	19,334	38,651	44,371	46,725	53,405	58,424	63,768	69,353	75,146	81,112	87,215	93,266	99,178	104,786	109,957	114,597	118,932	123,180	
Subtotal of surroundings in MWh	519,172	560,197	609,298	659,026	709,061	758,331	808,321	860,764	915,710	973,177	1,031,237	1,089,557	1,147,783	1,205,547	1,262,316	1,318,622	1,374,692	1,429,567	1,483,120	1,535,358	1,589,181
Subtotal of domestic cons. in MWh	1,949,332	2,069,037	2,201,124	2,338,402	2,477,444	2,616,902	2,757,962	2,902,038	3,048,842	3,198,033	3,347,312	3,495,959	3,643,222	3,788,326	3,935,492	4,085,360	4,238,265	4,393,366	4,550,652	4,710,253	4,875,196
Industrial and commercial consumption	403,399	427,803	453,667	481,135	509,165	537,750	566,735	596,035	625,539	655,127	684,673	714,046	743,107	771,717	801,428	832,283	864,326	897,603	932,160	968,044	1,005,316
Consumption of government entities	920,393	971,015	1,024,420	1,080,764	1,138,044	1,196,684	1,255,665	1,317,751	1,380,084	1,444,175	1,509,307	1,575,234	1,641,677	1,706,330	1,778,864	1,853,597	1,931,448	2,012,568	2,097,096	2,185,174	2,276,952
Other consumption	41,291	43,975	46,833	49,877	53,020	56,294	59,573	62,969	66,432	69,953	73,520	77,123	80,748	84,381	88,178	92,146	96,293	100,626	105,154	109,886	114,831
Industrial estates / industrial projects																					
- Ruwi		50,000	100,000	150,000	200,000	300,000	400,000	500,000	600,000	624,000	648,960	674,918	701,915	729,992	759,191	789,559	821,141	853,987	888,147	923,672	960,619
Total annual consumption in MWh	3,314,435	3,561,831	3,826,064	4,100,178	4,377,693	4,706,990	5,040,134	5,378,293	5,720,896	5,991,288	6,263,773	6,537,280	6,810,669	7,082,746	7,363,174	7,653,145	7,951,473	8,258,150	8,573,209	8,897,035	9,232,916
Annual growth rate		7.5%	7.4%	7.2%	6.8%	7.5%	7.1%	6.7%	6.4%	4.7%	4.5%	4.4%	4.2%	4.0%	4.0%	3.9%	3.9%	3.9%	3.8%	3.8%	3.8%
System losses (of energy sent out)	17.26%	17.26%	17.26%	16.00%	15.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%	14.00%
Total sent out energy in MWh	4,006,694	4,305,977	4,625,414	4,881,164	5,150,227	5,473,244	5,860,621	6,253,830	6,652,205	6,966,613	7,283,457	7,601,488	7,919,383	8,235,751	8,561,630	8,899,006	9,245,899	9,602,500	9,968,848	10,345,389	10,735,952
Total load factor	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51
Peak load sent out in MW	923	989	1,060	1,116	1,174	1,246	1,334	1,423	1,512	1,581	1,650	1,719	1,788	1,856	1,926	1,959	2,073	2,149	2,227	2,308	2,391

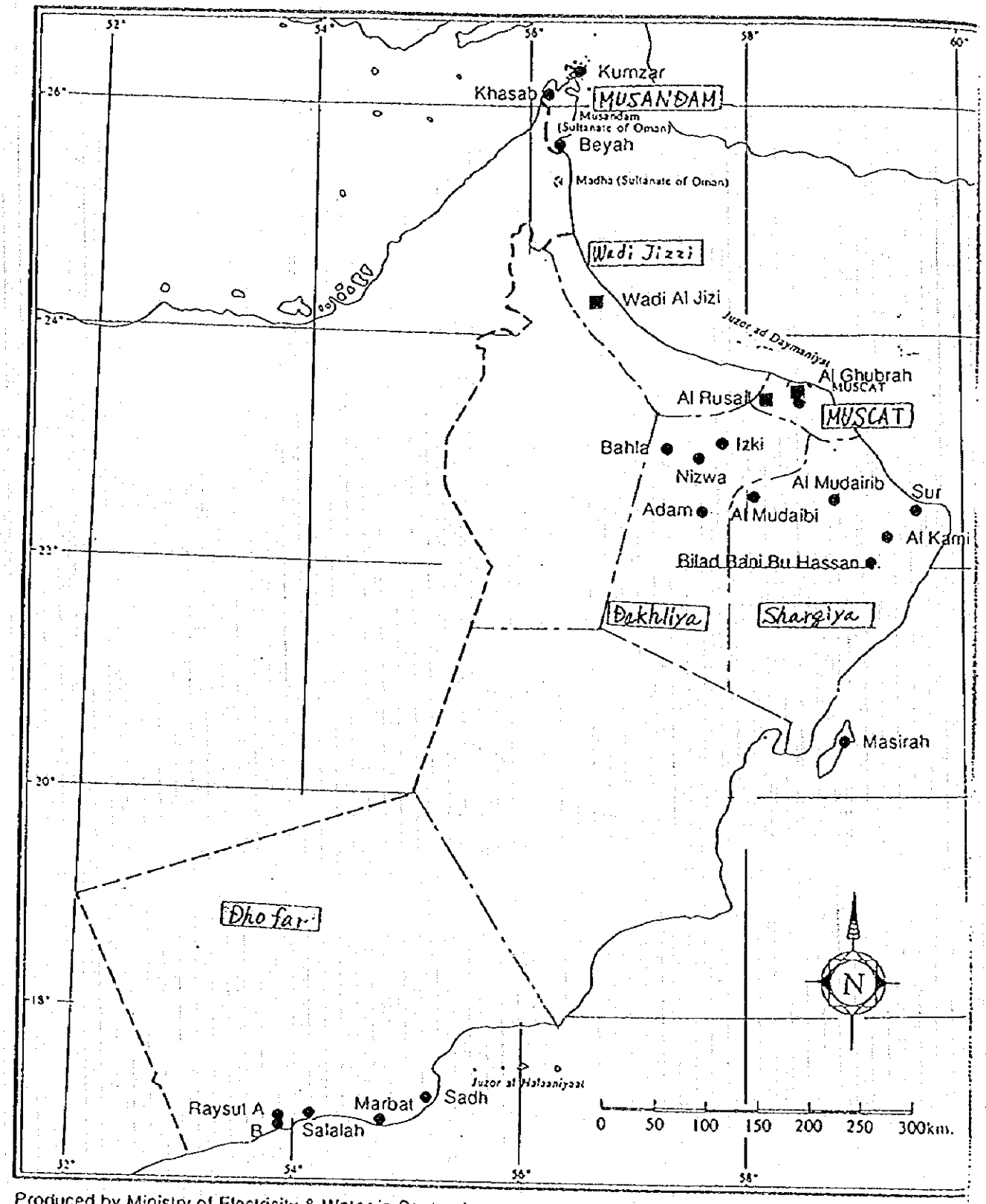
MEW Ministry of Electricity and Water Muscat / Oman	Master Plan Study for the Electric Power Sector Power demand and load forecast Region 1: Capital area and surroundings, including South Batinah Total Energy Consumption of load forecast scenarios	Fichtner Consulting Engineers Stuttgart / Germany Annex: 4.5 - 25



別添５．発電所位置

SULTANATE OF OMAN

LOCATION OF POWER STATIONS



Produced by Ministry of Electricity & Water in September 1993.

Based on National Survey Authority OR 3, edition 1, dated April 1993.

This map is not an authority on International Boundaries.

--- International Boundary
■ Gas Turbine Station
● Steam Turbine Station
● Diesel Engine Station

別添６．発電コスト

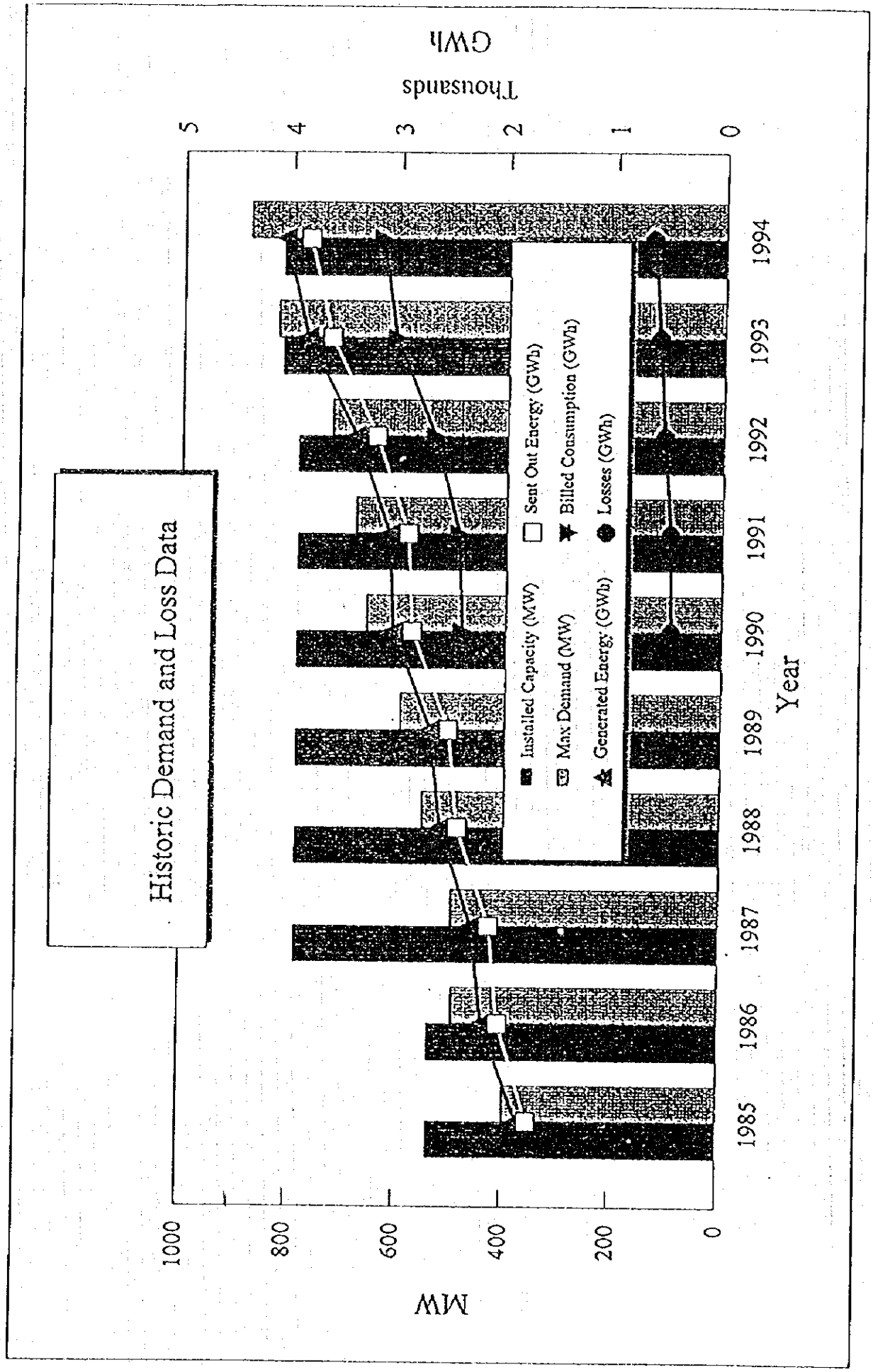
Costs Of Generation - Muscat and Wadi Jizzi Systems
(Prices are in current terms)

	Fuel OR million	Manpower OR million	Spares OR million	Depreciation OR million	Other Costs OR million	Total OR million	Generation MWh	Cost Bz/kWh
Muscat								
1991	28.92	1.60	1.34	4.74	0.51	37.11	3 083 467	12.04
1992	32.41	1.79	2.18	4.74	0.72	41.84	3 397 364	12.32
1993	35.87	2.01	2.75	5.28	0.77	46.68	3 862 485	12.09
1994	38.38	1.86	1.94	5.28	0.89	48.35	4 071 924	11.87
Wadi Jizzy								
1991	7.14	0.38	0.34	1.12	0.05	9.03	668 309	13.51
1992	8.09	0.41	0.24	1.12	0.04	9.90	755 761	13.10
1993	9.00	0.53	0.48	1.28	0.08	11.37	870 826	13.06
1994	9.77	0.55	0.23	1.51	0.07	12.13	937 750	12.94
Rural								
1991	14.04	0.89	1.42	1.99	0.64	18.98	430 223	44.12
1992	13.28	1.17	1.97	1.92	0.61	18.95	482 695	39.26
1993	13.75	1.27	3.26	1.91	0.67	20.86	559 188	37.30
1994	15.26	1.42	3.11	2.43	0.70	22.92	622 016	36.85
Northern Total								
1991	50.10	2.87	3.10	7.85	1.20	65.12	4 181 999	15.57
1992	53.78	3.37	4.39	7.78	1.37	70.69	4 635 820	15.25
1993	58.62	3.81	6.49	8.47	1.52	78.91	5 292 499	14.91
1994	63.41	3.83	5.28	9.22	1.66	83.40	5 631 690	14.81

Costs of Transmission and Distribution - Total Northern Sector

	T&D Costs	Admin. Costs	Billing	Total
1991	6.4	4.53	2.05	12.98
1992	6.1	5.97	2.23	14.30
1993	7.12	5.28	2.59	14.99
1994	6.77	4.84	2.46	14.07

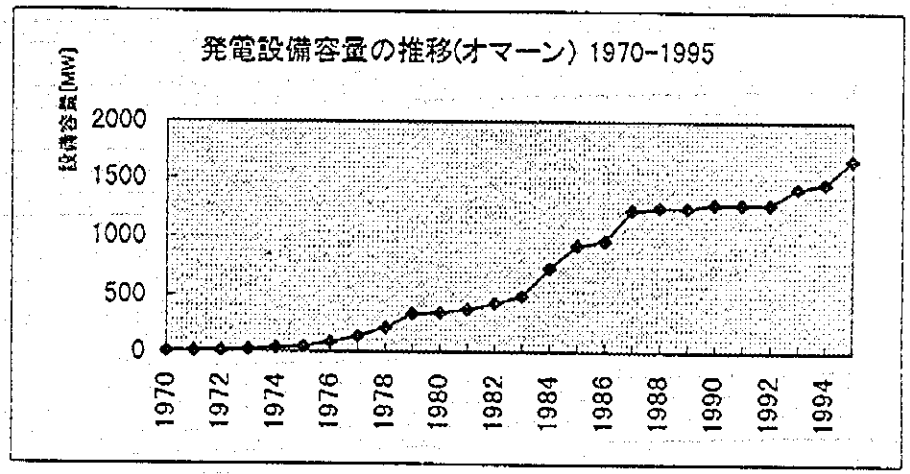
別添７．電力需要と損失の推移

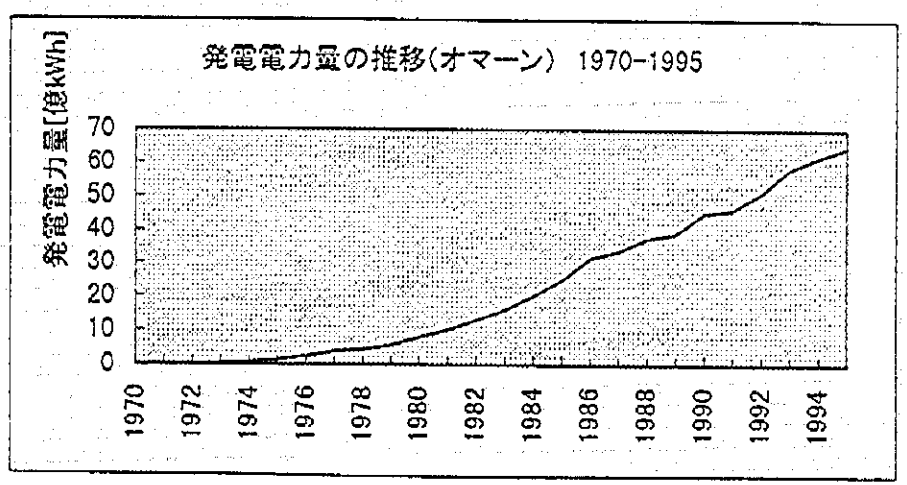


発電容量の推移(全オマーン) 1970－1995

	設備容量[MW]	発電電力量[億kWh]
1970	4	0.08
1971	6	0.13
1972	11	0.26
1973	19	0.47
1974	38	0.91
1975	47	1.54
1976	87	2.66
1977	137	4.04
1978	209	4.68
1979	332	6
1980	344	8.18
1981	374	10.46
1982	426	13.17
1983	493	16.15
1984	735	20.16
1985	924	24.98
1986	964	31.8
1987	1222	33.92
1988	1243	37.73
1989	1245	39.27
1990	1277	45.04
1991	1274	46.25
1992	1276	51.13
1993	1411	58.33
1994	1454	61.87
1995	1661	65

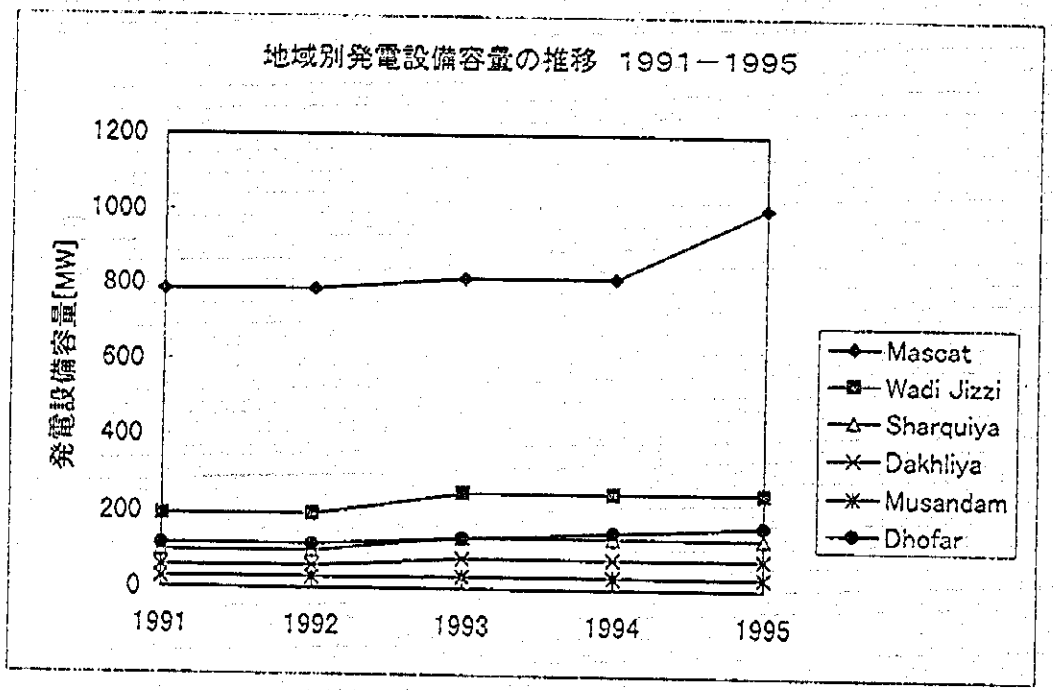
参照: 日本　9社計　約8000億kWh
　　沖縄電力　　約　66億kWh





地域別発電容量の推移 91－95 [MW]

電力供給系統	1991	1992	1993	1994	1995
Mascat	785	787	817	817	1007
Wadi Jizzi	194	194	251.1	251.1	251.1
Sharquiya	96.9	97	131.6	131.6	131.6
Dakhliya	56.9	56.9	77.2	77.2	77.1
Musandam	28	27.9	30.7	30.1	30.1
Dhofar	113.3	113.3	132.2	147.1	164.1
Oman Total	1274.1	1276.1	1439.8	1454.1	1661
(North Oman Total)	(1160.8)	(1162.8)	(1307.6)	(1307)	(1496.9)

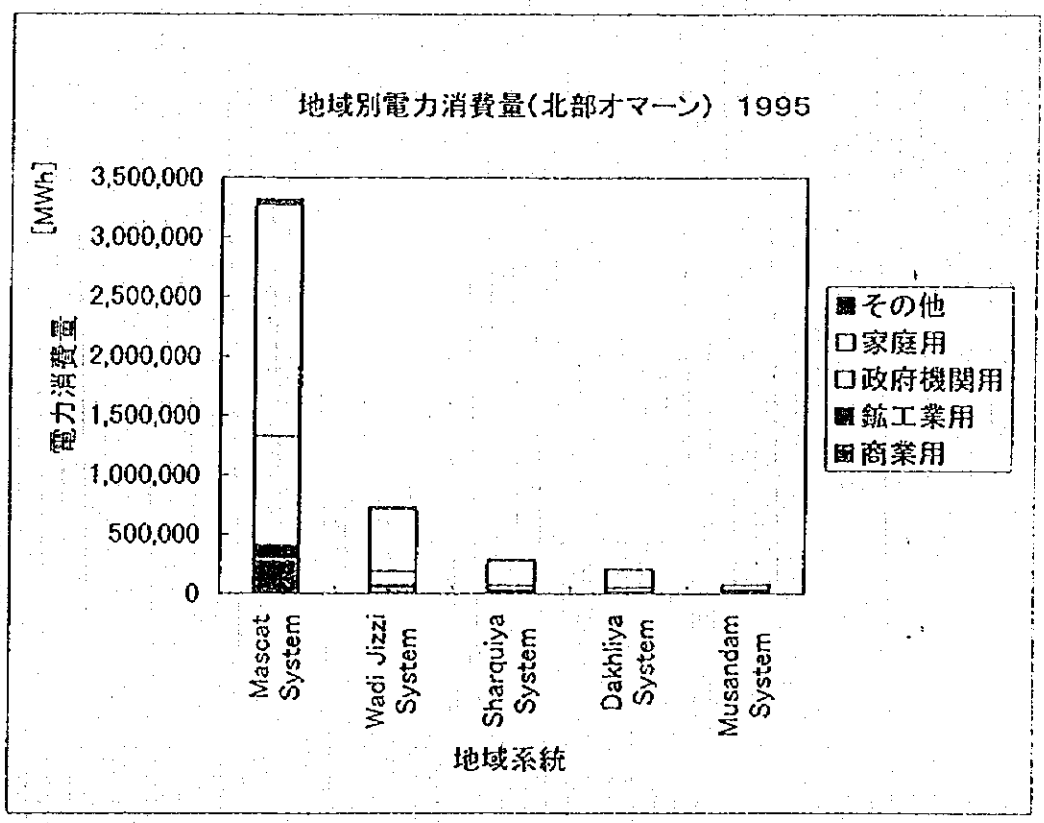


別添９．電力消費量

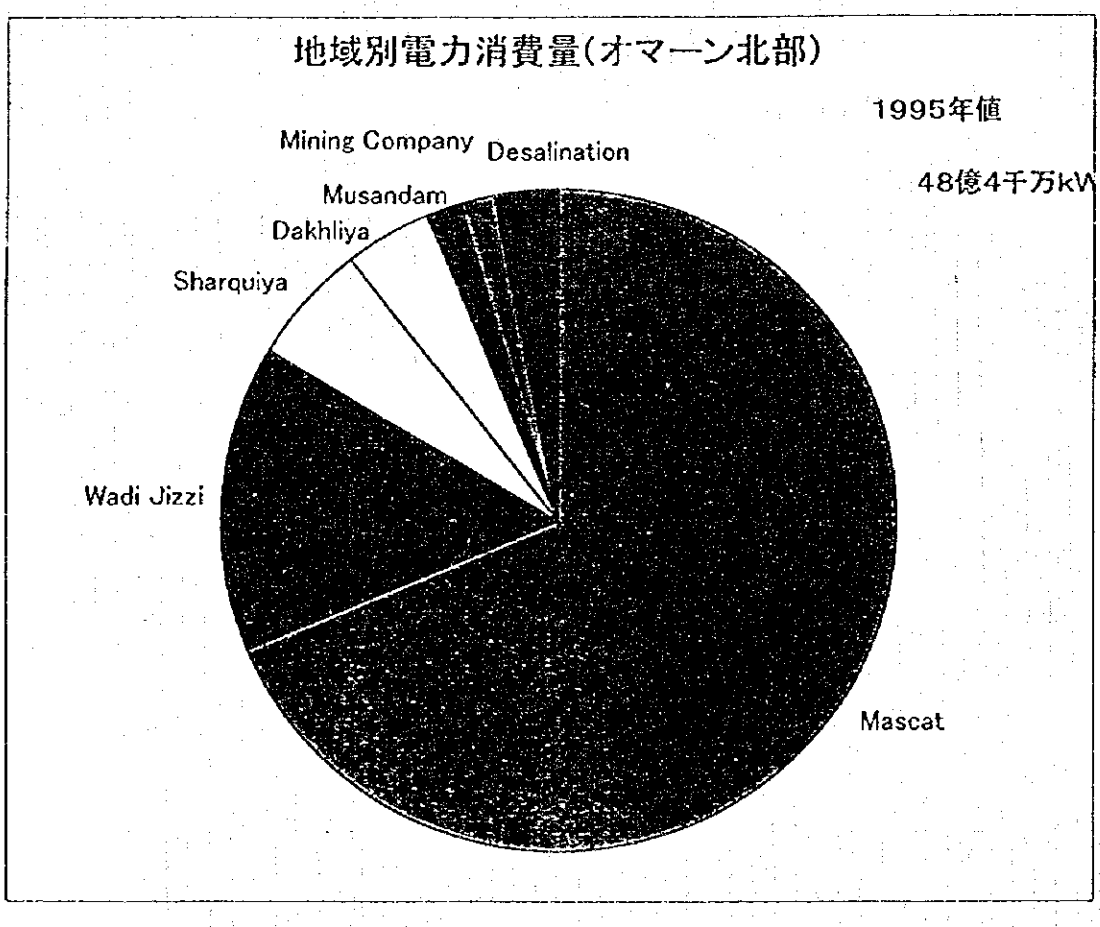
オマーン北部地域　電力消費量 1995　[MWh]

電力供給系統	商業用	鉱工業用	政府機関用	家庭用	その他	合計
Mascat System	305,296	98,104	920,393	1,949,352	41,292	3,314,437
Wadi Jizzi System	61,449	6,929	118,098	524,593	16,077	727,146
Sharquiya System	24,614	1,027	39,891	214,839	3,476	283,847
Dakhliya System	16,017	85	32,880	155,215	137	204,334
Musandam System	5,104	34	24,921	44,539	411	75,009
Mining Company					79,893	79,893
Desalination Plant					152,592	152,592
North Oman Total	412,480	106,179	1,136,183	2,888,538	293,878	4,837,258

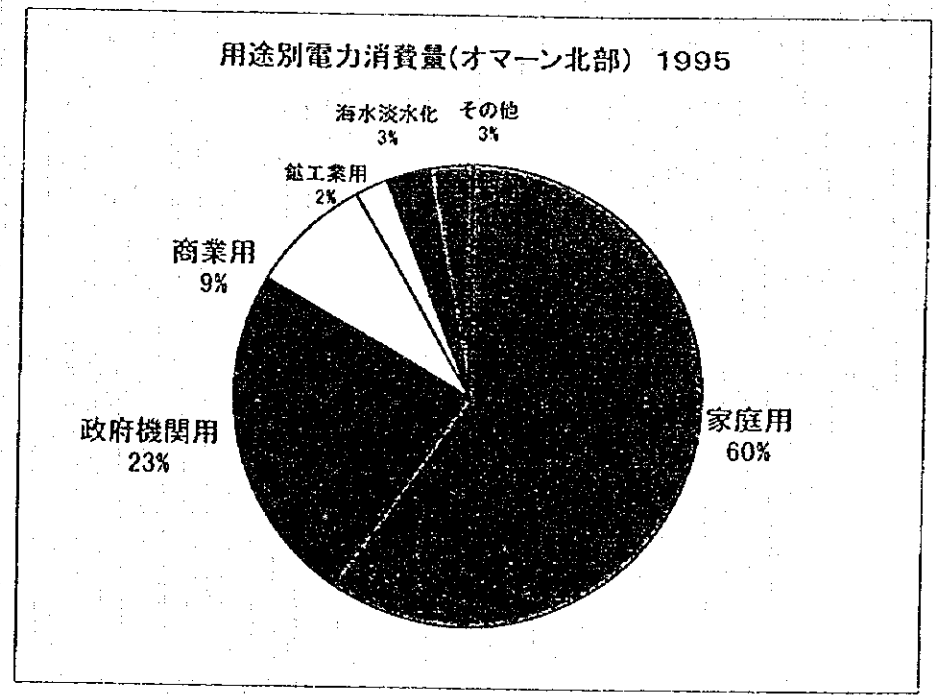
出典：Appendix-7



電力供給系統	
Mascat	3,314,437
Wadi Jizzi	727,146
Sharquiya	283,847
Dakhliya	204,334
Musandam	75,009
Mining Company	79,893
Desalination	152,592
North Oman Total	4,837,258



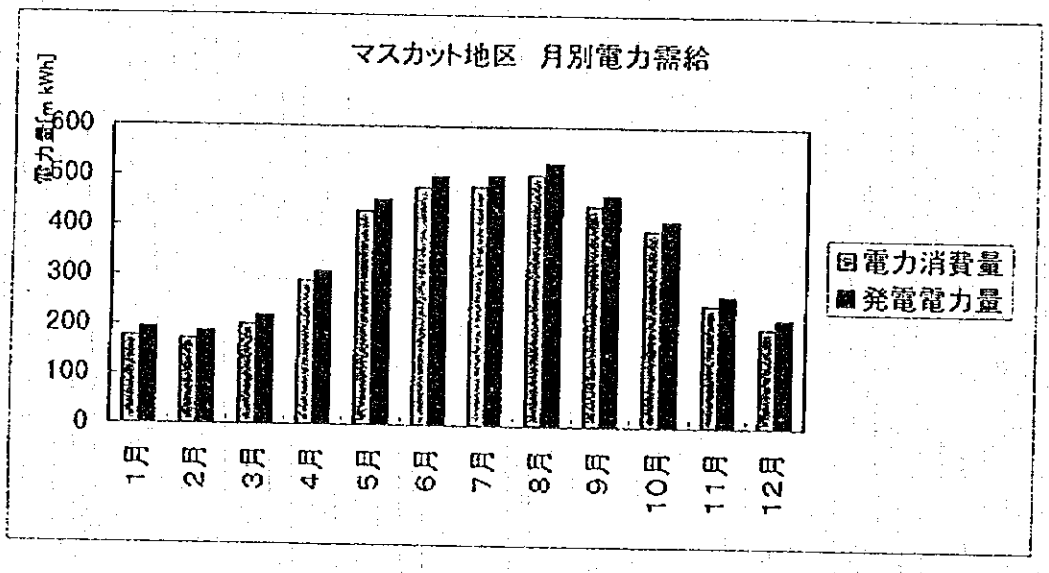
	家庭用	政府機関用	商業用	鉱工業用	海水淡水化	その他	合計
North Oman	2,888,538	1,136,183	412,480	106,179	152,592	141,286	4,837,258



月別電力消費量・発電量

マスカット地域　月別電力消費量の推移　1991－1995

	電力消費量	発電電力量	1992	1993	1994	1991
1月	175.8	192.5				134.6
2月	171.3	186.6				122
3月	201.1	217.6				161.1
4月	288.8	307.7				242.8
5月	429.5	451.5				296.1
6月	477.4	499.1				346.5
7月	478.7	501.4				372.1
8月	504	526.7				326.9
9月	442	462.5				307.8
10月	393.6	411.7				257.2
11月	245	262.8				179.5
12月	200.1	217.3				157.6
	4007.3	4237.4				



収集資料リスト

No.	資料名	発行元、著者	発行年	入手先、価格
1	Study of the electric power sector in the sultanate of Oman	Ministry of Electricity and Water(MEW)	1985年12月	MEW
2	Master plan study for the electric power sector, Volume I(Text)	MEW	1997年 2月	MEW
3	Master plan study for the electric power sector, Volume II (Annexes)	MEW	1997年 2月	MEW
4	Ratification of the fifth five-year development plan	Ministry of Development Affairs	1995年 6月	大使館
5	The study of power and energy losses in the Muscat system electricity network	MEW	1996年 7月	MEW
6	The development of electricity and water services 1970-1995	MEW		MEW
7	Muscat 132KV Trippings -1996	MEW	1996年	MEW
8	Load Flow Study -1996 Summer Conditions	MEW		MEW
9	Electricity Generation & Distribution and Water Production from Desalination Plants; Annual Report 1996	MEW		MEW
10	Load Flow Study; 132KV System -1997 Summer	MEW	1997年	MEW
11	Muscat City Maps; 1:20,000	National Survey Authority	1996年7月	6.000RO
12	Sur Town Plan; 1:10,000	National Survey Authority	1996年10月	2.000RO
13	Maps of the Sultanate of Oman; 1:1,300,000	National Survey Authority	1997年4月	2.000RO
14	Oil and the transformation of Oman; 1970-1995	Mohamed bin Musa Al-Yousef	1995年	9.000RO
15	Milestones	First Publishing	1996年	2.000RO
16	A Tribute to Oman 1996-1997	Apex Publication		5.000RO
17	Business Oman, February 1997	Al Roya Publishing	1997年 2月	1.000RO
18	Agrifish Oman	Al Nahda Publishing & Distribution		2.000RO

	Item	Description	Reference
17	Power Flow and Impedence Map	Existing Power Flow and Impedence Future Expansion Power Flow and Impedence	
18	Demand Records	Load Curves(Monthly, Daily) in whole Oman, Mascat System and Jizzi System	
19	Demand Forecast	Short Term (2000), Medium Term (2005) and Long Term (2010)	1.Domestic 2.Government 3.Commercial 4.Industrial 5.Desalination 6.Others
20	Future Expansion	Future Expansion Program of Power System (Power Plant, Substation and Transmission Line) Long Term Supply (max KW, KWh)	
21	Operation and Maintenance Mamual	Manual for Frequent Maintenance and Recoverly Method of Faulted Equipment	
22	Construction Cost	Unit (km) Cost of Transmission Line Unit (KVA) Cost of Substation Unit (KW) Cost of Power Station	
23	Operation and Maintenance Yearly Costs	Transmission Lines Substations Power Stations	
24	Energy Loss	Technical Loss Non-Technical Loss (Illegal connection, Meter Tampering, Meter By-pass etc)	
25	WH-meter	WH-meter Installing (Power Utility, Consumer) Meter reading interval	
26	Information concerned to this project	Organization Chart Annual Report	
27	National Statistics	GNP, Population, Economic Indies etc.	
28	Weather	Temparature, Humidity, Wind, Rainfall and Lighting	

別添 11. 質問状

QUESTIONNAIRE

April, 1997

JAPAN INTERNATIONAL COOPERATION AGENCY

	Item	Description	Reference
1	Transmission	Main Transmission System on the geographical map in Oman. (132kV)	A map of the whole system from which we can find the location of principal power plants , substation and trunk transmission line.
2	Transmission Distribution	Sub Transmission and Distribution system in Muscat.	A map of the whole system from which we can find the location of substation, sub-transmission and distribution line in Muscat.
3	Transmission Distribution	Transmission and Distribution Loss	According to your information, the transmission and distribution losses are 2.6% and 4.5%. Could you explain in more detail.
4	Transmission	Construction planning of transportation facility.	We would like to know the outline of your electric transportation facilities construction program.
5	Development	Projects of the power plant *Maneh PP *Barka PP *Sur PP *Wadi Zizzi	Please describe the name of plant, name of the owner, total output, fuel type, on-line date,
6	Reliability	Frequency and voltage fluctuations	
7	Reliability	Total minute of outage per low-voltage customers.	We would like to know the reliability index for low voltage customers, both scheduled outage and faults
8	Dispatching	How to dispatch the electricity supply and demand in Muscat.	Are there some Control Center
9	Electrification	The rate of Electrification	Village and housing base
10	Climate	Max. and Min. temperature in every month. Rain fall	
11	Load factor	The cause of summer peak demand	Wide-use of air-conditioning

	Item	Description	Reference
12	Economic	Economical Figure and Developing Program	
13	Forecast	Demand and supply forecast	
14	Elec. Law	Electricity Law and Regulation	
15	Policy	Electric Power Industry Policy	Electric, Energy and Environment Policy
16	Self-generator	Status of Self-generator	

	Item	Description	Reference
17	Power Flow and Impedence Map	Existing Power Flow and Impedence Future Expansion Power Flow and Impedence	
18	Demand Records	Load Curves(Monthly, Daily) in whole Oman, Mascat System and Jizzi System	
19	Demand Forecast	Short Term (2000), Medium Term (2005) and Long Term (2010)	1.Domestic 2.Government 3.Commercial 4.Industrial 5.Desalination 6.Others
20	Future Expansion	Future Expansion Program of Power System (Power Plant, Substation and Transmission Line) Long Term Supply (max KW, KWh)	
21	Operation and Maintenance Mamual	Manual for Frequent Maintenance and Recoverly Method of Faulted Equipment	
22	Construction Cost	Unit (km) Cost of Transmission Line Unit (KVA) Cost of Substation Unit (KW) Cost of Power Station	
23	Operation and Maintenance Yearly Costs	Transmission Lines Substations Power Stations	
24	Energy Loss	Technical Loss Non-Technical Loss (Illegal connection, Meter Tampering, Meter By-pass etc)	
25	WH-meter	WH-meter Installing (Power Utility, Consumer) Meter reading interval	
26	Information concerned to this project	Organization Chart Annual Report	
27	National Statistics	GNP, Population, Economic Indies etc.	
28	Weather	Temparature, Humidity, Wind, Rainfall and Lighting	


JICA