

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

ELECTRICITY OF VIETNAM (EVN)
THE SOCIALIST REPUBLIC OF VIETNAM

MASTER PLAN STUDY
ON
PUMPED STORAGE POWER PROJECT
AND OPTIMIZATION
FOR PEAKING POWER GENERATION
IN
VIETNAM

FINAL REPORT
SUPPORTING REPORT

JUNE 2004

THE TOKYO ELECTRIC POWER CO., INC.
TOKYO ELECTRIC POWER SERVICES CO., LTD.

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FINAL REPORT

SUPPORTING REPORT

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ACRONYMS / ABBREVIATIONS

ABB	: Asea Brow Boveri
ACSR	: Alumunum Conductor Steel Reinforced
ADB	: Asian Development Bank
AFC	: Automatic Frequency Control
ASEAN	: Association of Southeast Asian Nations
BOD	: Board of Directors
BOM	: Board of Management
BOT	: Build -Operate-Transfer
CC	: Combined Cycle
CDM	: Clean Development Mechanism
C/P	: Counterpart
DO	: Diesel Oil
DSCR	: Debt Service Coverage Ratio
DSM	: Demand Side Management
DSS	: Daily Start and Stop
DWT	: Dead Weight Tonnage
EGAT	: Electricity Generating Authority of Thailand
EIA	: Environmental Impact Assessment
EL	: Elevation
EVN	: Elctricity of Vietnam
FO	: Furnace Oil
FPD	: Forest Protection Department
F/S	: Feasibility Study
GDP	: Gross Domestic Product
GMS	: Greater Mekong Sulregaiion
GT	: Gas Turbine
HPC	: Hydro Power Station
IE	: Institute of Energy
IGA	: Inter Government Agreement
IMPACT	: Integrated & Multi-purpose Package of Advanced Computational Tools for power system engineering
IPP	: Independent Power Producer
JBIC	: Japan Bank for International Cooperation
JETRO	: Japan External Trade Organization
JICA	: Japan International Cooperation Agency
LOLE	: Loss-of-Load Expectation
M/P , MP	: Master Plan
MARD	: Ministry of Agriculture and Rural Development
MOI	: Ministry of Industry
MOF	: Ministry of Finance
MONRE	: Ministry of Natural Resources and Environment
MOSTE	: Ministry of Science Technology and Environment
MPI	: Ministry of Planning and Investment
NCMPC	: Ho Chi Minh Power Company
NEDO	: New Energy and Industrial Technology Development Organization
NGO(s)	: Non-Government Organization(s)
NLDC	: National Load Dispatching Centers

ACRONYMS / ABBREVIATIONS

NTFP	: Non-Timber Forest Products
ODA	: Official Development Assistance
OE	: Oil Equivalent
OECD	: The Overseas Economic Cooperation
OJT	: On the Job Training
Pre-F/S	: Preliminary Feasibility Study
P/S	: Power Station
PDPAT II	: Power Development Planning Assist Tool
PECC1	: Power Engineering Consulting Company 1
PLN	: Perusahaan Umum Listrik Negara
PP	: Power Purchase
PSPP	: Pumped Storage Power Plant
PSS/E	: Power System Simulator for Engineering
RETICS	: Reliability Evaluation Tool for Inter-Connected System
SCADA	: Supervisory Control and Data Acquisition
SEA	: Strategic Environmental Assessment
SFR	: Self Financing Ratio
Son La PMB	: Son La Hydropower Project Management Board
S/S	: Substation
ST	: Steam Turbine
TA	: Technical Assistance
TEPCO	: Tokyo Electric Power Company
TEPCO	: Tokyo Electric Power Services Co., Ltd.
T/L	: Transmission Line
VEEA	: Vietnam Electricity Engineering Association
WASP	: Wien Automatic System Planning Package
WB	: The World Bank
WSS	: Weekly Start and Stop
WWF	: World Wide Fund for Nature

UNITS

Prefixes

μ	:	micro-	=	10^{-6}
m	:	milli-	=	10^{-3}
c	:	centi-	=	10^{-2}
d	:	deci-	=	10^{-1}
da	:	deca-	=	10
h	:	hecto-	=	10^2
k	:	kilo-	=	10^3
M	:	mega-	=	10^6
G	:	giga-	=	10^9

Units of Length

m	:	meter
km	:	kilometer

Units of Area

m^2	:	square meter
km^2	:	square kilometer

Units of Volume

m^3	:	cubic meter
l	:	liter
kl	:	kiloliter

Units of Mass

kg	:	kilogram
t	:	ton (metric)
DWT	:	Dead Weight Tonnage

Units of Energy

kcal	:	kilocalorie
kWh	:	kilowatt-hour
MWh	:	megawatt-hour
GWh	:	gigawatt-hour
Btu	:	British thermal unit

Units of Heating Value

kcal/kg	:	kilocalorie per kilogram
Btu/kWh	:	British thermal unit per kilo watt hour

Units of Temperature

$^{\circ}C$:	degree Celsius or Centigrade
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Units of Electricity

W	:	watt
kW	:	kilowatt
MW	:	megawatt
GW	:	gigawatt
A	:	ampere
V	:	volt
kV	:	kilovolt
kVA	:	kilovolt ampere
MVA	:	megavolt ampere
MVar	:	megavar (mega volt-ampere-reactive)
Ω	:	ohm

Units of Time

s	:	second
min	:	minute
h	:	hour
d	:	day
m	:	month
y	:	year

Units of Flow Rate

m/s	:	meter per second
m^3/s	:	cubic meter per second

Units of Currency

VND	:	Vietnam Dong
US\$/USD	:	US Dollar

Exchange Rate

1 US\$	=	VND 15,375	As of March 2003
1 US\$	=	VND 15,430	As of June 2003
1 US\$	=	VND 15,570	As of December 2003

APPENDIX 2-1

Operation characteristics of thermal power plants

Appendix 2-1: Operational characteristics of thermal power plants

	Unit No.	Unit size	Type	Fuel Type	F.O.R	S.O	Min. Output	Efficiency			Year of Operation
		(MW)			(%)	(days/year)	(MW)	at 100% load BTU/kWh	at 75% load BTU/kWh	at 50% load BTU/kWh	
BARIA	1	33	GT	Gas	6	30	3	12937	13335	15932	1995
	2	33	GT	Gas	6	30	3	12435	12041	14629	1995
	3	33	GT	Gas	6	30	3	11494	10693	14132	1996
	4	56	ST		6	30	12				1999
	5	33	GT	Gas	6	30	3	11942	12341	15226	1996
	6	33	GT	Gas	6	30	3	12510	12321	14828	1997
	7	33	GT	Gas	6	30	3	11942	12241	14928	1997
	8	56	ST		6	30	12				2002
PHU MY 1	1	240	GT	Gas	6	35	72	10411	11035	12856	2001
	2	240	GT	Gas	6	35	72	10411	11035	12856	2001
	3	240	GT	Gas	6	35	72	10411	11035	12856	2001
	4	370	ST		6	35	72				2002
PHU MY 2.1	1	144	GT	Gas	6	30	36	11500	12600	14500	1997
	2	144	GT	Gas	6	30	36	11600	12700	14700	1998
	3	140	ST		6	30	36				2003
	4	144	GT	Gas	6	30	36	11870	12940	15120	1998
	5	144	GT	Gas	6	30	36	11830	12900	15100	1999
	6	140	ST		6	30	36				2004
PHU MY 2.2	1	240	GT	Gas	6	30	36	11010	11670	13596	2004
	2	240	GT	Gas	6	30	36	11010	11670	13596	2004
	3	240	ST		6	30	36				2004
PHU MY 3	1	240	GT	Gas	6	30	36	11010	11670	13596	2003
	2	240	GT	Gas	6	30	36	11010	11670	13596	2003
	3	240	ST		6	30	36				2003
PHU MY 4	1	150	GT	Gas	6	30	36	11500	12600	14500	2003
	2	150	GT	Gas	6	30	36	11500	12600	14500	2003
	3	150	ST		6	30	36				2005
O MON 1	1	300	ST	Gas	6	35	75	11845	13356	15950	2005
	2	300	ST	Gas	6	35	75	11845	13356	15950	2006
O MON 3	1	300	ST	Gas	6	35	75	11845	13356	15950	2010
	2	300	ST	Gas	6	35	75	11845	13356	15950	2011
CAN THO	1	33	ST	FO	6	30	3	275	281	288.7	1994
	2	37.5	GT	DO	6	30	3	283.5	290	340	1996
	3	37.5	GT	DO	6	30	3	286.5	295.5	346	1996
	4	37.5	GT	DO	6	30	3	287.5	299	351	1997
	5	37.5	GT	DO	6	30	3	281	294	347	1997
THUDUC	1	33	ST	FO	6	30	3	296	295	305	1990
	2	62	ST	FO	6	30	5	270	271	281	1991
	3	62	ST	FO	6	30	5	275	272	280	1992
	4	15	GT	DO	10	40		393	428	543	1975
	5	10	GT	DO	10	40		312	355	381	1975
	6	33	GT	DO	6	30	3	280	283	336	1994
	7	33	GT	DO	6	30	3	288	300	364	1995
NINH BINH	1	25	ST	Coal	20	50	10	579	595	660	1975
	2	25	ST	Coal	20	50	10	552	575	610	1975
	3	25	ST	Coal	20	50	10	561	580	625	1975
	4	25	ST	Coal	20	50	10	585	600	630	1975
	5	300	ST	Coal	8	40	105	2200		2400	2008
UONG BI	1	50	ST	Coal	20	50	16	516	523	538	1970
	2	55	ST	Coal	20	50	16	499	501	518	1970
	3	300	ST	Coal	8	40	105	2200		2400	2005
	4	300	ST	Coal	8	40	105	2200		2400	2009
PHA LAI	1	100	ST	Coal	15	50	38	401	406	427	1985
	2	100	ST	Coal	15	50	38	403	404	442	1986
	3	100	ST	Coal	15	50	38	405	406	432	1987
	4	100	ST	Coal	15	50	38	401	426	408	1988
	5	300	ST	Coal	8	40	105	2200		2400	2002
	6	300	ST	Coal	8	40	105	2200		2400	2003

APPENDIX 3-1

Demand forecasts (Revised 5th Master Plan)

Appendix 3-1: Demand Forecasts (Revised 5th Master Plan)

- 1 BASE CASE: THE WHOLE COUNTRY
 - 1.1 Base Case: The North Region
 - 1.2 Base Case: The Central Region
 - 1.3 Base Case: The South Region

- 2 HIGH CASE: THE WHOLE COUNTRY
 - 2.1 High Case: The North Region
 - 2.2 High Case: The Central Region
 - 2.3 High Case: The South Region

1. BASE CASE: THE WHOLE COUNTRY

GDP Increase

	'01-21005	'01-2010	'11-2015	'16-2020
Agriculture	4.0%	4.4%	3.1%	3.1%
Industry	10.3%	9.4%	7.6%	7.6%
Service	5.9%	6.4%	6.6%	6.6%
Total GDP	7.1%	7.3%	6.5%	6.5%

Population Increase

	'01-21005	'01-2010	'11-2015	'16-2020	2000	2020
Urban	4.32%	4.32%	4.47%	4.47%	18.79	24.2%
Rural	0.32%	-0.11%	-0.63%	-1.28%	58.82	75.8%
Total	1.35%	1.21%	1.14%	1.08%	77.61	100%

	Electricity Consumption				Service GWh	Agriculture GWh	Others GWh	Total Sales GWh	T&D Loss %	Total Demand GWh	Self Use %	Total Generation GWh	Load Factor %	Peak Demand MW	Population		
	Industry GWh	Household Total	Urban	Rural											Total Mil.	Urban Mil.	Rural Mil.
2000	9,089	10,986	7,342	3,644	1,084	427	812	22,398	14.03%	26,054	2.0%	26,595	62.09%	4,890	77.614	18.793	58.822
2001	10,400	12,646	8,463	4,183	1,258	478	970	25,752	14.0%	29,940	2.2%	30,603	62.23%	5,614	78.612	19.604	59.008
2002	12,681	14,333	9,722	4,611	1,373	506	1,335	30,228	13.7%	35,025	2.2%	35,795	62.34%	6,554	79.646	20.451	59.195
2003	15,036	15,835	10,861	4,975	1,553	552	1,470	34,446	13.5%	39,832	2.6%	40,901	62.89%	7,424	80.718	21.334	59.384
2004	17,833	17,501	12,133	5,368	1,760	603	1,618	39,315	13.3%	45,325	2.6%	46,535	63.48%	8,368	81.829	22.255	59.574
2005	21,157	19,348	13,555	5,793	1,997	659	1,782	44,944	12.9%	51,595	2.7%	53,000	64.00%	9,454	82.981	23.216	59.765
2006	24,318	21,222	15,038	6,184	2,214	704	1,966	50,423	12.5%	57,608	2.8%	59,268	64.69%	10,459	83.913	24.219	59.694
2007	27,954	23,286	16,684	6,602	2,454	751	2,168	56,613	12.0%	64,321	2.8%	66,174	65.38%	11,555	84.889	25.265	59.625
2008	32,139	25,558	18,511	7,048	2,720	802	2,391	63,610	11.5%	71,915	2.9%	74,063	66.08%	12,795	85.912	26.356	59.557
2009	36,955	28,062	20,537	7,525	3,015	857	2,637	71,526	11.1%	80,467	2.9%	82,870	66.79%	14,165	86.984	27.494	59.490
2010	42,499	30,820	22,786	8,034	3,343	915	2,909	80,486	10.8%	90,210	3.0%	93,000	67.50%	15,728	88.106	28.681	59.425
2011	46,705	33,325	24,832	8,493	3,625	958	3,140	87,754	10.4%	97,941	3.1%	101,074	67.80%	17,019	89.006	29.963	59.043
2012	51,328	36,041	27,063	8,978	3,931	1,003	3,390	95,694	9.8%	106,372	3.1%	109,775	68.10%	18,403	89.968	31.301	58.666
2013	56,409	38,986	29,495	9,491	4,263	1,050	3,659	104,368	9.7%	115,548	3.2%	119,368	68.40%	19,923	90.994	32.700	58.294
2014	61,994	42,179	32,145	10,034	4,624	1,099	3,951	113,846	9.4%	125,607	3.2%	129,760	68.70%	21,562	92.087	34.161	57.927
2015	68,131	45,642	35,033	10,609	5,014	1,151	4,265	124,203	8.9%	136,388	3.4%	141,260	69.00%	23,370	93.251	35.687	57.564
2016	73,339	49,062	37,880	11,182	5,376	1,199	4,566	133,541	8.7%	146,266	3.40%	151,415	69.30%	24,943	94.097	37.281	56.816
2017	78,944	52,745	40,959	11,786	5,764	1,249	4,889	143,590	8.5%	156,929	3.50%	162,621	69.60%	26,674	95.030	38.947	56.083
2018	84,978	56,712	44,289	12,423	6,179	1,300	5,234	154,404	8.3%	168,380	3.50%	174,487	69.90%	28,497	96.051	40.687	55.364
2019	91,474	60,985	47,889	13,095	6,625	1,354	5,604	166,042	8.2%	180,874	3.60%	187,629	70.20%	30,512	97.165	42.505	54.660
2020	98,467	65,587	51,783	13,804	7,103	1,410	6,000	178,568	8%	194,063	3.6%	201,367	70.50%	32,606	98.373	44.404	53.969

1.1 BASE CASE: THE NORTH REGION

GDP Increase

	'01-21005	'01-2010	'11-2015	'16-2020
Agriculture	4.0%	3.5%	3.0%	3.0%
Industry	10.3%	9.8%	7.6%	7.6%
Service	5.5%	6.4%	6.6%	6.6%
Total GDP	6.6%	7.0%	6.4%	6.4%

Population Increase

	'01-21005	'01-2010	'11-2015	'16-2020	2000	
Urban	4.30%	4.30%	4.50%	4.50%	6.10	17.0%
Rural	0.60%	0.30%	-0.10%	-0.50%	29.79	83.0%
Total	1.27%	1.14%	1.03%	0.96%	35.90	100%

	Electricity Consumption								Total Sales GWh	T&D Loss %	Total Demand GWh	Load Factor %	Peak Demand MW	Population			Per capita	
	Industry GWh	Household		Service GWh	Agriculture GWh	Others GWh	Total Mil.	Urban Mil.						Rural Mil.	Sales kWh pc	Generation kWh pc		
	Total	Urban	Rural															
2000	3,227	4,840	2,807	2,033	277	296	384	9,024	13.9%	10,481	54.70%	2,187	35.90	6.104	29.792	134.8	251.4	
2001	3,653	5,498	3,189	2,309	319	322	439	10,231	13.8%	11,876	54.70%	2,478	36.34	6.366	29.970	151.3	281.6	
2002	4,359	6,256	3,503	2,753	373	307	572	11,867	13.6%	13,729	54.72%	2,864	36.79	6.640	30.150	170.0	322.6	
2003	5,189	6,841	3,907	2,934	408	337	619	13,394	13.4%	15,467	56.05%	3,225	37.26	6.925	30.331	183.6	359.5	
2004	6,178	7,485	4,357	3,128	446	369	669	15,148	13.2%	17,451	57.41%	3,553	37.74	7.223	30.513	198.3	401.4	
2005	7,356	8,193	4,859	3,334	487	405	724	17,165	12.8%	19,680	58.80%	3,914	38.23	7.534	30.696	214.3	449.0	
2006	8,469	8,906	5,372	3,534	537	430	790	19,133	12.4%	21,842	59.71%	4,281	38.65	7.858	30.788	230.5	495.1	
2007	9,752	9,686	5,939	3,746	592	457	863	21,349	11.9%	24,233	60.64%	4,677	39.08	8.195	30.881	247.9	546.4	
2008	11,228	10,538	6,566	3,971	653	486	941	23,846	11.4%	26,915	61.58%	5,119	39.52	8.548	30.973	266.6	603.4	
2009	12,928	11,469	7,260	4,210	720	517	1,028	26,662	10.9%	29,923	62.53%	5,605	39.98	8.915	31.066	286.9	666.9	
2010	14,886	12,489	8,026	4,462	794	549	1,122	29,839	10.5%	33,339	63.50%	6,153	40.46	9.299	31.159	308.7	737.5	
2011	16,356	13,422	8,731	4,691	862	576	1,215	32,430	10.2%	36,114	64.03%	6,615	40.85	9.717	31.128	328.6	794.0	
2012	17,972	14,429	9,497	4,932	936	603	1,316	35,256	9.9%	39,130	64.57%	7,108	41.25	10.154	31.097	349.8	854.7	
2013	19,748	15,515	10,330	5,185	1,016	632	1,426	38,337	9.6%	42,408	65.11%	7,645	41.68	10.611	31.066	372.3	919.8	
2014	21,699	16,687	11,237	5,451	1,103	663	1,544	41,696	9.3%	45,972	65.65%	8,219	42.12	11.089	31.035	396.1	989.8	
2015	23,843	17,953	12,223	5,730	1,198	694	1,673	45,361	8.9%	49,787	66.20%	8,843	42.59	11.588	31.004	421.5	1,065.0	
2016	25,673	19,221	13,213	6,009	1,285	724	1,790	48,693	8.7%	53,333	66.67%	9,402	42.96	12.109	30.849	447.4	1,133.5	
2017	27,644	20,584	14,283	6,301	1,378	754	1,916	52,276	8.5%	57,132	67.15%	10,008	43.35	12.654	30.695	474.8	1,205.9	
2018	29,766	22,047	15,440	6,607	1,478	786	2,051	56,128	8.3%	61,208	67.63%	10,646	43.76	13.224	30.541	503.8	1,282.5	
2019	32,050	23,619	16,691	6,928	1,585	819	2,196	60,269	8.2%	65,652	68.11%	11,346	44.21	13.819	30.388	534.3	1,363.3	
2020	34,511	25,307	18,042	7,265	1,700	853	2,350	64,722	8.0%	70,350	68.60%	12,074	44.68	14.441	30.236	566.4	1,448.7	

1.2 BASE CASE: THE CENTRAL REGION

GDP Increase

	01-21005	01-2010	11-2015	16-2020
Agriculture	3.8%	4.0%	3.6%	3.6%
Industry	10.5%	10.0%	8.2%	8.2%
Service	5.4%	6.2%	6.8%	6.8%
Total GDP	6.8%	7.3%	6.9%	6.9%

Population Increase

	'01-21005	'01-2010	'11-2015	'16-2020	2000	
Urban	4.10%	4.10%	4.30%	4.30%	3.11	25.4%
Rural	0.30%	-0.20%	-0.70%	-1.50%	9.16	74.6%
Total	1.32%	1.13%	1.09%	0.94%	12.27	100%

	Electricity Consumption				Service GWh	Agriculture GWh	Others GWh	Total Sales GWh	T&D Loss %	Total Demand GWh	Load Factor %	Peak Demand MW	Population			Per capita	
	Industry GWh	Household Total	Urban	Rural									Total Mil.	Urban Mil.	Rural Mil.	Sales kWh pc	Generation kWh pc
2000	669	1,349	985	364	158	59	38	2,273	14.3%	2,650	54.50%	555	12.27	3.115	9.159	109.9	185.2
2001	803	1,550	1,131	418	180	71	50	2,654	14.2%	3,095	54.50%	648	12.43	3.242	9.187	124.7	213.6
2002	1,026	1,633	1,192	441	121	85	187	3,051	13.9%	3,542	54.54%	741	12.59	3.375	9.214	129.7	242.4
2003	1,285	1,829	1,348	481	154	93	203	3,563	13.6%	4,124	55.83%	863	12.76	3.514	9.242	143.4	279.3
2004	1,609	2,049	1,525	525	195	102	220	4,175	13.3%	4,815	57.15%	985	12.93	3.658	9.270	158.5	322.9
2005	2,014	2,297	1,724	573	248	111	239	4,909	13.0%	5,642	58.50%	1,128	13.11	3.808	9.298	175.3	374.6
2006	2,393	2,542	1,925	617	271	118	263	5,586	12.6%	6,391	59.37%	1,260	13.24	3.964	9.279	191.9	421.8
2007	2,843	2,813	2,149	664	296	125	289	6,366	12.2%	7,250	60.26%	1,408	13.39	4.126	9.260	210.1	475.5
2008	3,377	3,114	2,399	715	323	133	318	7,265	11.8%	8,237	61.16%	1,577	13.54	4.295	9.242	230.1	536.7
2009	4,012	3,449	2,678	770	353	141	349	8,304	11.4%	9,373	62.07%	1,768	13.69	4.471	9.223	251.8	606.4
2010	4,767	3,820	2,990	830	386	149	384	9,506	11.0%	10,686	63.00%	1,988	13.86	4.655	9.205	275.6	685.9
2011	5,275	4,137	3,260	877	418	156	412	10,398	10.6%	11,631	63.57%	2,146	14.00	4.855	9.140	295.6	743.0
2012	5,837	4,481	3,555	927	452	163	443	11,376	10.2%	12,669	64.14%	2,316	14.14	5.064	9.076	316.9	804.5
2013	6,459	4,855	3,876	980	489	170	476	12,450	9.8%	13,802	64.72%	2,503	14.29	5.281	9.013	339.7	870.9
2014	7,148	5,261	4,226	1,036	529	178	511	13,627	9.4%	15,041	65.31%	2,703	14.46	5.508	8.950	363.9	942.5
2015	7,910	5,702	4,607	1,095	572	186	549	14,919	9.0%	16,394	65.90%	2,925	14.63	5.745	8.887	389.7	1,019.6
2016	8,559	6,114	4,964	1,150	614	194	587	16,068	8.7%	17,599	66.33%	3,118	14.75	5.992	8.754	414.6	1,089.6
2017	9,260	6,557	5,348	1,209	660	202	627	17,307	8.5%	18,915	66.77%	3,332	14.87	6.250	8.623	440.9	1,163.7
2018	10,020	7,033	5,762	1,271	710	211	670	18,643	8.3%	20,330	67.21%	3,558	15.01	6.519	8.493	468.5	1,241.9
2019	10,841	7,543	6,208	1,336	763	220	715	20,083	8.2%	21,877	67.65%	3,806	15.17	6.799	8.366	497.4	1,324.3
2020	11,730	8,092	6,688	1,404	820	230	764	21,636	8.0%	23,517	68.10%	4,066	15.33	7.092	8.240	527.8	1,411.2

1.3 BASE CASE: THE SOUTH REGION

GDP Increase

	01-21005	01-2010	11-2015	16-2020
Agriculture	4.0%	4.6%	3.0%	3.0%
Industry	10.2%	9.1%	7.5%	7.5%
Service	6.4%	6.5%	6.5%	6.5%
Total GDP	7.6%	7.4%	6.6%	6.6%

Population Increase

	'01-21005	'01-2010	'11-2015	'16-2020	2000	2000
Urban	4.40%	4.40%	4.50%	4.50%	9.57	32.5%
Rural	-0.10%	-0.73%	-1.50%	-2.60%	19.87	67.5%
Total	1.45%	1.32%	1.29%	1.27%	29.45	100%

	Electricity Consumption				Service GWh	Agriculture GWh	Others GWh	Total Sales GWh	T&D Loss %	Total Demand GWh	Load Factor %	Peak Demand MW	Population			Per capita	
	Industry GWh	Household Total	Urban	Rural									Total Mil.	Urban Mil.	Rural Mil.	Sales kWh pc	Generation kWh pc
2000	5,193	4,797	3,550	1,247	649	73	390	11,101	14.1%	12,923	68.70%	2,147	29.45	9.575	19.871	162.9	377.0
2001	5,944	5,598	4,142.5	1,455.5	758	85	481	12,866	14.0%	14,969	68.70%	2,487	29.85	9.996	19.851	187.6	431.1
2002	7,296	6,444	5,026.7	1,417.8	879	113	576	15,309	13.8%	17,754	68.73%	2,949	30.27	10.436	19.831	212.9	505.8
2003	8,561	7,165	5,606	1,559	992	122	648	17,489	13.6%	20,242	68.80%	3,439	30.71	10.895	19.811	233.3	569.5
2004	10,046	7,967	6,252	1,715	1,119	132	729	19,992	13.3%	23,059	68.87%	3,913	31.17	11.375	19.791	255.6	641.5
2005	11,788	8,858	6,972	1,887	1,262	143	819	22,870	13.0%	26,272	68.94%	4,457	31.65	11.875	19.771	279.9	722.7
2006	13,456	9,775	7,741	2,033	1,406	155	912	25,704	12.5%	29,376	69.25%	4,965	32.02	12.398	19.627	305.2	802.6
2007	15,360	10,787	8,596	2,191	1,565	169	1,016	28,897	12.0%	32,838	69.56%	5,525	32.43	12.943	19.484	332.7	891.2
2008	17,533	11,906	9,545	2,361	1,744	184	1,132	32,498	11.6%	36,763	69.87%	6,162	32.85	13.513	19.342	362.4	989.2
2009	20,015	13,144	10,599	2,545	1,942	200	1,260	36,560	11.2%	41,171	70.19%	6,870	33.31	14.107	19.200	394.6	1,097.6
2010	22,847	14,511	11,769	2,743	2,163	217	1,403	41,141	10.9%	46,185	70.50%	7,678	33.79	14.728	19.060	429.5	1,217.6
2011	25,074	15,766	12,842	2,925	2,346	227	1,513	44,926	10.5%	50,196	70.60%	8,339	34.16	15.391	18.774	461.5	1,315.0
2012	27,519	17,131	14,012	3,119	2,544	237	1,631	49,062	10.1%	54,574	70.70%	9,054	34.58	16.083	18.493	495.5	1,419.0
2013	30,202	18,616	15,289	3,327	2,759	248	1,758	53,582	9.7%	59,338	70.80%	9,837	35.02	16.807	18.215	531.5	1,530.0
2014	33,147	20,230	16,682	3,548	2,992	259	1,895	58,523	9.4%	64,595	70.90%	10,693	35.51	17.563	17.942	569.8	1,648.3
2015	36,379	21,987	18,203	3,784	3,245	271	2,043	63,924	9.0%	70,207	71.00%	11,627	36.03	18.354	17.673	610.3	1,774.3
2016	39,107	23,726	19,704	4,022	3,477	281	2,189	68,780	8.7%	75,334	71.10%	12,454	36.39	19.179	17.213	651.9	1,889.9
2017	42,040	25,604	21,329	4,276	3,725	292	2,345	74,007	8.5%	80,882	71.20%	13,362	36.81	20.043	16.766	695.6	2,010.6
2018	45,193	27,633	23,087	4,545	3,991	304	2,513	79,634	8.3%	86,842	71.30%	14,327	37.27	20.944	16.330	741.3	2,136.4
2019	48,582	29,823	24,991	4,832	4,277	316	2,693	85,690	8.2%	93,345	71.40%	15,389	37.79	21.887	15.905	789.1	2,267.4
2020	52,226	32,188	27,052	5,136	4,583	328	2,885	92,210	8.0%	100,196	71.50%	16,498	38.36	22.872	15.492	839.0	2,403.6

2. HIGH CASE: THE WHOLE COUNTRY

GDP Increase

	'01-21005	'01-2010	'11-2015	'16-2020
Agriculture	4.0%	4.4%	3.6%	3.6%
Industry	10.3%	10.0%	9.4%	9.4%
Service	5.9%	7.0%	7.7%	7.7%
Total GDP	7.1%	7.8%	8.0%	8.0%

Population Increase

	'01-21005	'01-2010	'11-2015	'16-2020	2000
Urban	4.32%	4.32%	4.47%	4.47%	18.79
Rural	0.32%	-0.11%	-0.63%	-1.28%	58.82
Total	1.35%	1.21%	1.14%	1.08%	77.61

	Electricity Consumption				Service GWh	Agriculture GWh	Others GWh	Total Sales GWh	T&D Loss %	Total Demand GWh	Self Use %	Total Generation GWh	Load Factor %	Peak Demand MW	Population		
	Industry GWh	Household Total	Urban	Rural											Total Mil.	Urban Mil.	Rural Mil.
2000	9,088.8	10,986.1	7,341.8	3,644.3	1,084.0	427.3	811.5	22,397.7	14.03%	26,054.3	2.0%	26,595.3	62.09%	4,890	77.614	18.793	58.822
2001	10,400	12,646	8,463	4,183	1,258	478	970	25,752	14.0%	29,940	2.2%	30,603	62.24%	5,613	78.612	19.604	59.008
2002	12,681	14,333	9,722	4,611	1,373	506	1,335	30,228	13.7%	35,025	2.2%	35,795	62.35%	6,554	79.646	20.451	59.195
2003	15,036	15,835	10,861	4,975	1,553	552	1,470	34,446	13.5%	39,832	2.6%	40,901	62.67%	7,450	80.718	21.334	59.384
2004	17,833	17,501	12,133	5,368	1,760	603	1,618	39,315	13.3%	45,325	2.6%	46,535	63.00%	8,432	81.829	22.255	59.574
2005	21,157	19,348	13,555	5,793	1,997	659	1,782	44,944	12.9%	51,595	2.7%	53,000	64.00%	9,454	82.981	23.216	59.765
2006	24,814	21,222	15,038	6,184	2,250	707	2,003	50,996	12.5%	58,263	2.8%	59,941	64.69%	10,578	83.913	24.219	59.694
2007	29,111	23,286	16,684	6,602	2,535	758	2,251	57,941	12.0%	65,830	2.8%	67,727	65.38%	11,826	84.889	25.265	59.625
2008	34,164	25,558	18,511	7,048	2,856	813	2,529	65,921	11.5%	74,528	2.9%	76,753	66.08%	13,260	85.912	26.356	59.557
2009	40,108	28,062	20,537	7,525	3,218	872	2,842	75,102	11.1%	84,491	2.9%	87,014	66.79%	14,873	86.984	27.494	59.490
2010	47,101	30,820	22,786	8,034	3,626	936	3,195	85,678	10.8%	96,030	3.0%	99,000	67.50%	16,743	88.106	28.681	59.425
2011	53,182	33,341	24,851	8,490	3,964	981	3,472	94,940	10.4%	105,961	3.1%	109,351	67.80%	18,412	89.006	29.963	59.043
2012	60,060	36,076	27,103	8,973	4,333	1,028	3,774	105,271	9.8%	117,017	3.1%	120,760	68.10%	20,244	89.968	31.301	58.666
2013	67,841	39,043	29,559	9,484	4,736	1,077	4,103	116,800	9.7%	129,311	3.2%	133,586	68.40%	22,296	90.994	32.700	58.294
2014	76,645	42,263	32,238	10,025	5,177	1,129	4,460	129,674	9.4%	143,069	3.2%	147,798	68.70%	24,560	92.087	34.161	57.927
2015	86,609	45,758	35,160	10,598	5,659	1,184	4,848	144,057	8.9%	158,189	3.4%	163,840	69.00%	27,106	93.251	35.687	57.564
2016	95,032	49,345	38,172	11,173	6,137	1,233	5,235	156,982	8.7%	171,941	3.40%	177,993	69.26%	29,338	94.097	37.281	56.816
2017	104,280	53,222	41,442	11,779	6,656	1,285	5,653	171,095	8.5%	186,989	3.50%	193,771	69.52%	31,820	95.030	38.947	56.083
2018	114,433	57,413	44,993	12,420	7,218	1,339	6,104	186,507	8.3%	203,388	3.50%	210,765	69.78%	34,481	96.051	40.687	55.364
2019	125,579	61,945	48,848	13,097	7,829	1,395	6,591	203,338	8.2%	221,501	3.60%	229,773	70.04%	37,451	97.165	42.505	54.660
2020	137,817	66,845	53,034	13,811	8,490	1,453	7,117	221,723	8%	240,965	3.6%	250,035	70.30%	40,601	98.373	44.404	53.969

2.1 HIGH CASE: THE NORTH REGION

GDP Increase

	'01-21005	'01-2010	'11-2015	'16-2020
Agriculture	4.0%	4.0%	3.0%	3.0%
Industry	10.3%	10.8%	10.0%	10.0%
Service	5.5%	6.9%	7.8%	7.8%
Total GDP	6.6%	7.7%	8.0%	8.0%

Population Increase

	'01-21005	'01-2010	'11-2015	'16-2020	2000	2000
Urban	4.30%	4.30%	4.50%	4.50%	6.10	17.0%
Rural	0.60%	0.30%	-0.10%	-0.50%	29.79	83.0%
Total	1.27%	1.14%	1.03%	0.96%	35.90	100%

	Electricity Consumption				Service GWh	Agriculture GWh	Others GWh	Total Sales GWh	T&D Loss %	Total Demand GWh	Load Factor %	Peak Demand MW	Population			Per capita	
	Industry GWh	Household Total	Urban	Rural									Total Mil.	Urban Mil.	Rural Mil.	Sales kWh pc	Generation kWh pc
2000	3,227	4,840	2,807	2,033	277	296	384	9,024	13.9%	10,481	54.70%	2,187	35.90	6.104	29.792	134.8	251.4
2001	3,653	5,498	3,189.0	2,309.0	319	322	439	10,231	13.8%	11,876	54.70%	2,478	36.34	6.366	29.970	151.3	326.8
2002	4,359	6,256	3,503.0	2,753.0	373	307	572	11,867	13.6%	13,729	54.72%	2,864	36.79	6.640	30.150	170.0	322.6
2003	5,189	6,841	3,907	2,934	408	337	619	13,394	13.4%	15,467	56.05%	3,225	37.26	6.925	30.331	183.6	359.5
2004	6,178	7,485	4,357	3,128	446	369	669	15,148	13.2%	17,451	57.41%	3,553	37.74	7.223	30.513	198.3	401.4
2005	7,356	8,193	4,859	3,334	487	405	724	17,165	12.8%	19,680	58.80%	3,914	38.23	7.534	30.696	214.3	449.0
2006	8,666	8,906	5,372	3,534	545	431	809	19,357	12.4%	22,097	59.71%	4,331	38.65	7.858	30.788	230.5	500.9
2007	10,211	9,686	5,939	3,746	609	458	904	21,867	11.9%	24,820	60.64%	4,791	39.08	8.195	30.881	247.9	559.6
2008	12,030	10,538	6,566	3,971	680	487	1,010	24,745	11.4%	27,929	61.58%	5,312	39.52	8.548	30.973	266.6	626.1
2009	14,174	11,469	7,260	4,210	760	519	1,128	28,050	10.9%	31,481	62.53%	5,896	39.98	8.915	31.066	286.9	701.6
2010	16,700	12,489	8,026	4,462	849	552	1,261	31,849	10.5%	35,586	63.50%	6,568	40.46	9.299	31.159	308.1	787.2
2011	19,121	13,428	8,749	4,679	932	576	1,365	35,421	10.2%	39,445	64.03%	7,225	40.85	9.717	31.128	328.7	867.2
2012	21,894	14,443	9,536	4,906	1,022	601	1,478	39,438	9.9%	43,771	64.57%	7,951	41.25	10.154	31.097	350.1	956.0
2013	25,068	15,539	10,394	5,145	1,122	628	1,600	43,958	9.6%	48,626	65.11%	8,766	41.68	10.611	31.066	372.8	1,054.7
2014	28,703	16,725	11,330	5,395	1,231	655	1,733	49,047	9.3%	54,077	65.65%	9,668	42.12	11.089	31.035	397.0	1,164.4
2015	32,865	18,007	12,350	5,657	1,351	684	1,876	54,783	8.9%	60,129	66.20%	10,680	42.59	11.588	31.004	422.8	1,286.2
2016	36,316	19,322	13,406	5,917	1,467	710	2,019	59,835	8.7%	65,537	66.67%	11,554	42.96	12.109	30.849	449.8	1,392.9
2017	40,129	20,740	14,552	6,188	1,593	738	2,172	65,373	8.5%	71,446	67.15%	12,515	43.35	12.654	30.695	478.4	1,508.1
2018	44,343	22,268	15,796	6,472	1,730	767	2,337	71,445	8.3%	77,911	67.63%	13,551	43.76	13.224	30.541	508.8	1,632.5
2019	48,999	23,916	17,146	6,769	1,878	797	2,514	78,104	8.2%	85,081	68.11%	14,703	44.21	13.819	30.388	541.0	1,766.8
2020	54,144	25,693	18,612	7,080	2,040	828	2,705	85,409	8.0%	92,836	68.60%	15,933	44.68	14.441	30.236	575.1	1,911.7

2.2 HIGH CASE: THE CENTRAL REGION

GDP Increase

	01-21005	01-2010	11-2015	16-2020
Agriculture	3.8%	5.0%	4.0%	4.0%
Industry	10.5%	11.0%	10.2%	10.2%
Service	5.4%	7.0%	7.9%	7.9%
Total GDP	6.8%	8.2%	8.4%	8.4%

Population

	'01-21005	'01-2010	'11-2015	'16-2020	2000
Total	4.10%	4.10%	4.30%	4.30%	3.11
Urban	0.30%	-0.20%	-0.70%	-1.50%	9.16
Rural	1.32%	1.13%	1.09%	0.94%	12.27
Total					25.4%

	Electricity Consumption				Service GWh	Agriculture GWh	Others GWh	Total Sales GWh	T&D Loss %	Total Demand GWh	Load Factor %	Peak Demand MW	Population			Per capita Sales kWh pc	Per capita Generation kWh pc
	Industry GWh	Household Total	Urban	Rural									Total Mil.	Urban Mil.	Rural Mil.		
2000	669	1,349	985	384	158	59	38	2,273	14.3%	2,650	54.50%	555	12.27	3.115	9.159	109.9	185.2
2001	803	1,550	1,131	418	180	71	50	2,654	14.2%	3,095	54.50%	648	12.43	3.242	9.187	124.7	213.6
2002	1,026	1,633	1,192	441	121	85	187	3,051	13.9%	3,542	54.54%	741	12.59	3.375	9.214	129.7	242.4
2003	1,285	1,829	1,348	481	154	93	203	3,563	13.6%	4,124	55.83%	863	12.76	3.514	9.242	143.4	279.3
2004	1,609	2,049	1,525	525	195	102	220	4,175	13.3%	4,815	57.15%	985	12.93	3.658	9.270	158.5	322.9
2005	2,014	2,297	1,724	573	248	111	239	4,909	13.0%	5,642	58.50%	1,128	13.11	3.808	9.298	175.3	374.6
2006	2,479	2,542	1,925	617	275	121	266	5,683	12.6%	6,503	59.37%	1,282	13.24	3.964	9.279	191.9	429.2
2007	3,052	2,813	2,149	664	306	132	296	6,599	12.2%	7,516	60.26%	1,460	13.39	4.126	9.260	210.1	493.0
2008	3,757	3,114	2,399	715	340	144	329	7,685	11.8%	8,713	61.16%	1,668	13.54	4.295	9.242	230.1	567.7
2009	4,625	3,449	2,678	770	379	157	366	8,975	11.4%	10,130	62.07%	1,911	13.69	4.471	9.223	251.8	655.4
2010	5,693	3,820	2,990	830	421	171	407	10,512	11.0%	11,818	63.00%	2,198	13.86	4.655	9.205	275.6	758.5
2011	6,535	4,137	3,260	877	461	180	441	11,754	10.6%	13,148	63.57%	2,426	14.00	4.855	9.140	295.6	839.9
2012	7,501	4,481	3,555	927	505	190	478	13,155	10.2%	14,649	64.14%	2,679	14.14	5.064	9.076	316.9	930.3
2013	8,611	4,855	3,876	980	552	200	518	14,736	9.8%	16,337	64.72%	2,963	14.29	5.281	9.013	339.7	1,030.9
2014	9,884	5,261	4,226	1,036	605	210	562	16,522	9.4%	18,236	65.31%	3,277	14.46	5.508	8.950	363.9	1,142.7
2015	11,346	5,702	4,607	1,095	662	221	609	18,540	9.0%	20,373	65.90%	3,635	14.63	5.745	8.887	389.7	1,267.0
2016	12,504	6,137	4,984	1,154	720	232	656	20,248	8.7%	22,177	66.33%	3,930	14.75	5.992	8.754	416.2	1,373.1
2017	13,779	6,607	5,391	1,216	782	243	706	22,117	8.5%	24,171	66.77%	4,258	14.87	6.250	8.623	444.2	1,487.1
2018	15,184	7,113	5,831	1,282	850	254	760	24,162	8.3%	26,349	67.21%	4,611	15.01	6.519	8.493	473.8	1,609.5
2019	16,733	7,658	6,308	1,351	924	266	819	26,401	8.2%	28,760	67.65%	5,004	15.17	6.799	8.366	505.0	1,740.9
2020	18,440	8,247	6,823	1,424	1,004	279	882	28,852	8.0%	31,361	68.10%	5,422	15.33	7.092	8.240	537.9	1,881.9

2.3 HIGH CASE: THE SOUTH REGION

GDP Increase

	01-21005	01-2010	11-2015	16-2020
Agriculture	4.0%	4.6%	4.0%	4.0%
Industry	10.2%	9.5%	9.0%	9.0%
Service	6.4%	7.0%	7.6%	7.6%
Total GDP	7.6%	7.8%	7.9%	7.9%

Population '01-21005 '01-2010 '11-2015 '16-2020 2000

	'01-21005	'01-2010	'11-2015	'16-2020	2000
Total	4.40%	4.40%	4.50%	4.50%	9.57
Urban	-0.10%	-0.73%	-1.50%	-2.60%	19.87
Rural	1.45%	1.32%	1.29%	1.27%	29.45
Total					32.5%
					67.5%
					100%

Electricity Consumption

	Electricity Consumption		Service		Agriculture		Others		Total	T&D	Total	Load	Peak	Population			Per capita	
	Industry	Household	Urban	Rural	GWh	GWh	GWh	GWh	Sales	Loss	Demand	Factor	Demand	Total	Urban	Rural	Sales	Generation
	GWh	Total	Urban	Rural	GWh	GWh	GWh	GWh	GWh	%	GWh	%	MW	Mil.	Mil.	Mil.	kWh pc	kWh pc
2000	5,193	4,797	3,550	1,247	649	73	390	11,101	14.1%	12,923	68.70%	2,147	29.45	9.575	19.871	162.9	377.0	
2001	5,944	5,598	4,142.5	1,455.5	758	85	481	12,866	14.0%	14,969	68.70%	2,487	29.85	9.996	19.851	187.6	431.1	
2002	7,296	6,444	5,026.7	1,417.8	879	113	576	15,309	13.8%	17,754	68.73%	2,949	30.27	10.436	19.831	212.9	505.8	
2003	8,561	7,165	5,606	1,559	992	122	648	17,489	13.6%	20,242	68.80%	3,439	30.71	10.895	19.811	233.3	569.5	
2004	10,046	7,967	6,252	1,715	1,119	132	729	19,992	13.3%	23,059	68.87%	3,913	31.17	11.375	19.791	255.6	641.5	
2005	11,788	8,858	6,972	1,887	1,262	143	819	22,870	13.0%	26,272	68.94%	4,457	31.65	11.875	19.771	279.9	722.7	
2006	13,668	9,775	7,741	2,033	1,430	155	928	25,955	12.5%	29,663	69.25%	5,013	32.02	12.398	19.627	305.2	810.5	
2007	15,849	10,787	8,596	2,191	1,620	167	1,051	29,475	12.0%	33,494	69.56%	5,635	32.43	12.943	19.484	332.7	909.0	
2008	18,377	11,906	9,545	2,361	1,836	181	1,191	33,491	11.6%	37,886	69.87%	6,350	32.85	13.513	19.342	362.4	1,019.4	
2009	21,309	13,144	10,599	2,545	2,080	196	1,348	38,077	11.2%	42,880	70.19%	7,155	33.31	14.107	19.200	394.6	1,143.2	
2010	24,709	14,511	11,769	2,743	2,356	212	1,527	43,316	10.9%	48,626	70.50%	8,084	33.79	14.728	19.060	429.5	1,282.0	
2011	27,526	15,776	12,842	2,935	2,571	224	1,667	47,764	10.5%	53,368	70.60%	8,866	34.16	15.391	18.774	461.8	1,398.1	
2012	30,665	17,152	14,012	3,140	2,806	237	1,819	52,678	10.1%	58,596	70.70%	9,721	34.58	16.083	18.493	496.1	1,523.5	
2013	34,162	18,649	15,289	3,360	3,061	250	1,985	58,107	9.7%	64,348	70.80%	10,668	35.02	16.807	18.215	532.5	1,659.1	
2014	38,057	20,277	16,682	3,595	3,341	264	2,165	64,105	9.4%	70,756	70.90%	11,713	35.51	17.563	17.942	571.1	1,805.5	
2015	42,397	22,049	18,203	3,847	3,645	279	2,363	70,734	9.0%	77,687	71.00%	12,866	36.03	18.354	17.673	612.0	1,963.4	
2016	46,213	23,885	19,783	4,102	3,950	291	2,561	76,900	8.7%	84,228	71.10%	13,924	36.39	19.179	17.213	656.3	2,113.0	
2017	50,372	25,875	21,500	4,375	4,280	304	2,775	83,606	8.5%	91,373	71.20%	15,095	36.81	20.043	16.766	703.0	2,271.4	
2018	54,905	28,032	23,366	4,666	4,638	317	3,007	90,900	8.3%	99,127	71.30%	16,353	37.27	20.944	16.330	752.0	2,438.7	
2019	59,847	30,371	25,394	4,976	5,026	331	3,258	98,833	8.2%	107,661	71.40%	17,749	37.79	21.887	15.905	803.6	2,615.1	
2020	65,233	32,906	27,599	5,307	5,446	346	3,530	107,461	8.0%	116,768	71.50%	19,227	38.36	22.872	15.492	857.7	2,801.1	

Appendix 3-2

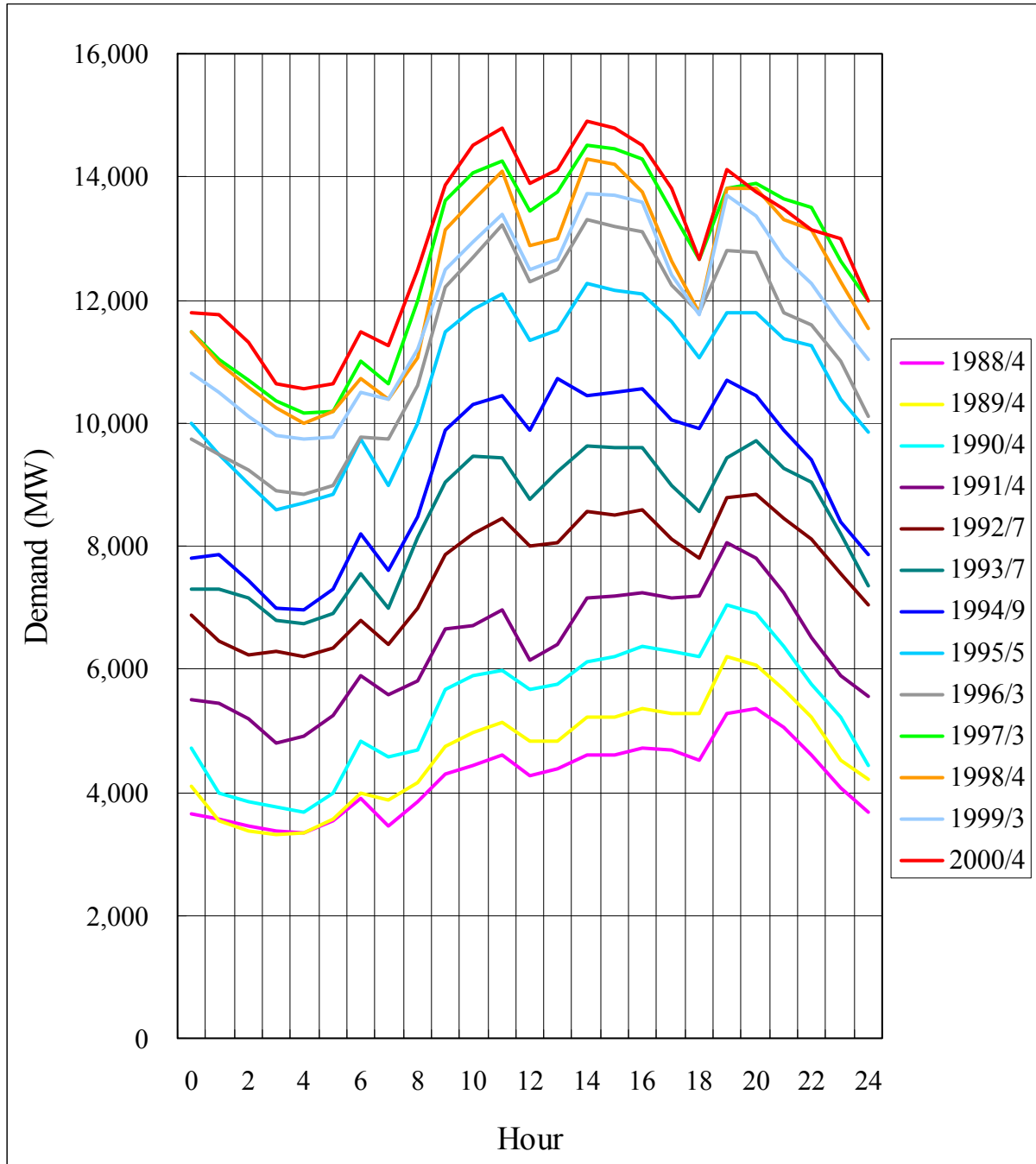
Load profile change in neighboring countries of Vietnam

Appendix 3-2: Load profile change in neighboring countries of Vietnam

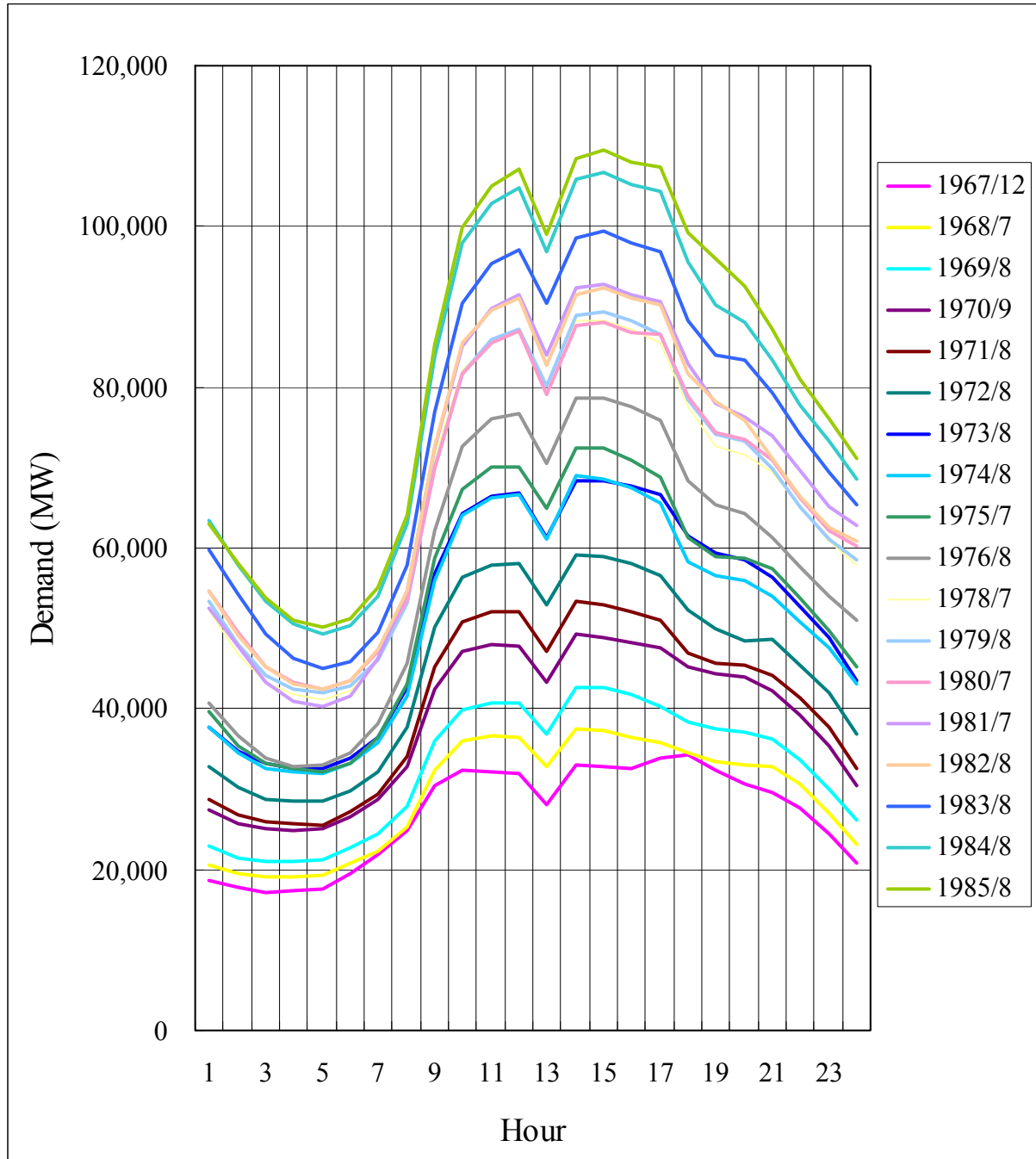
(Hourly demand of a day with the highest demand in a year)

- 1 Thailand (EGAT)
- 2 Japan (Whole Country)
- 3 Malaysia (TNB)
- 4 Philippines (MERALCO)
- 5 Indonesia (PLN)

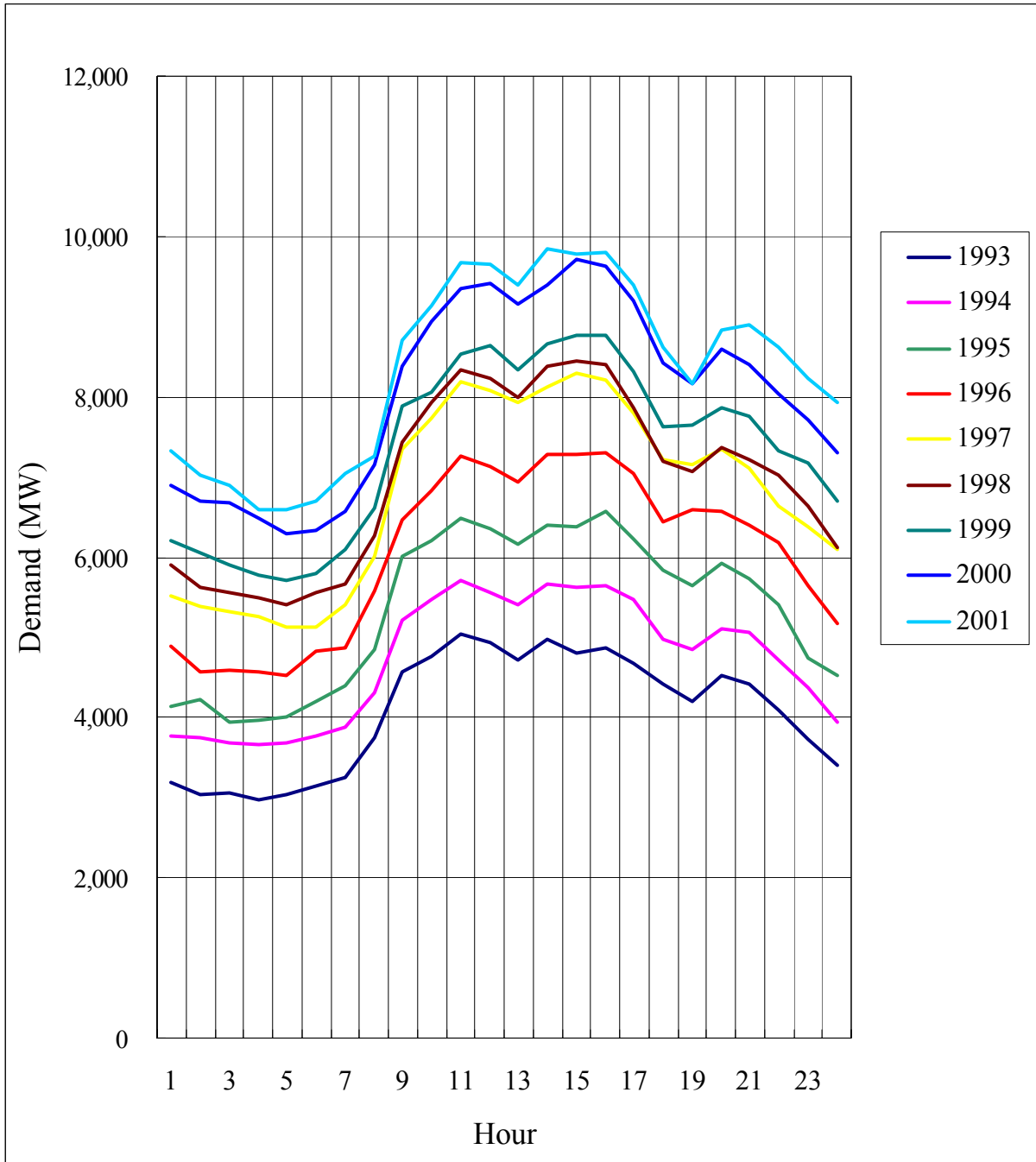
1. Thailand (EGAT)



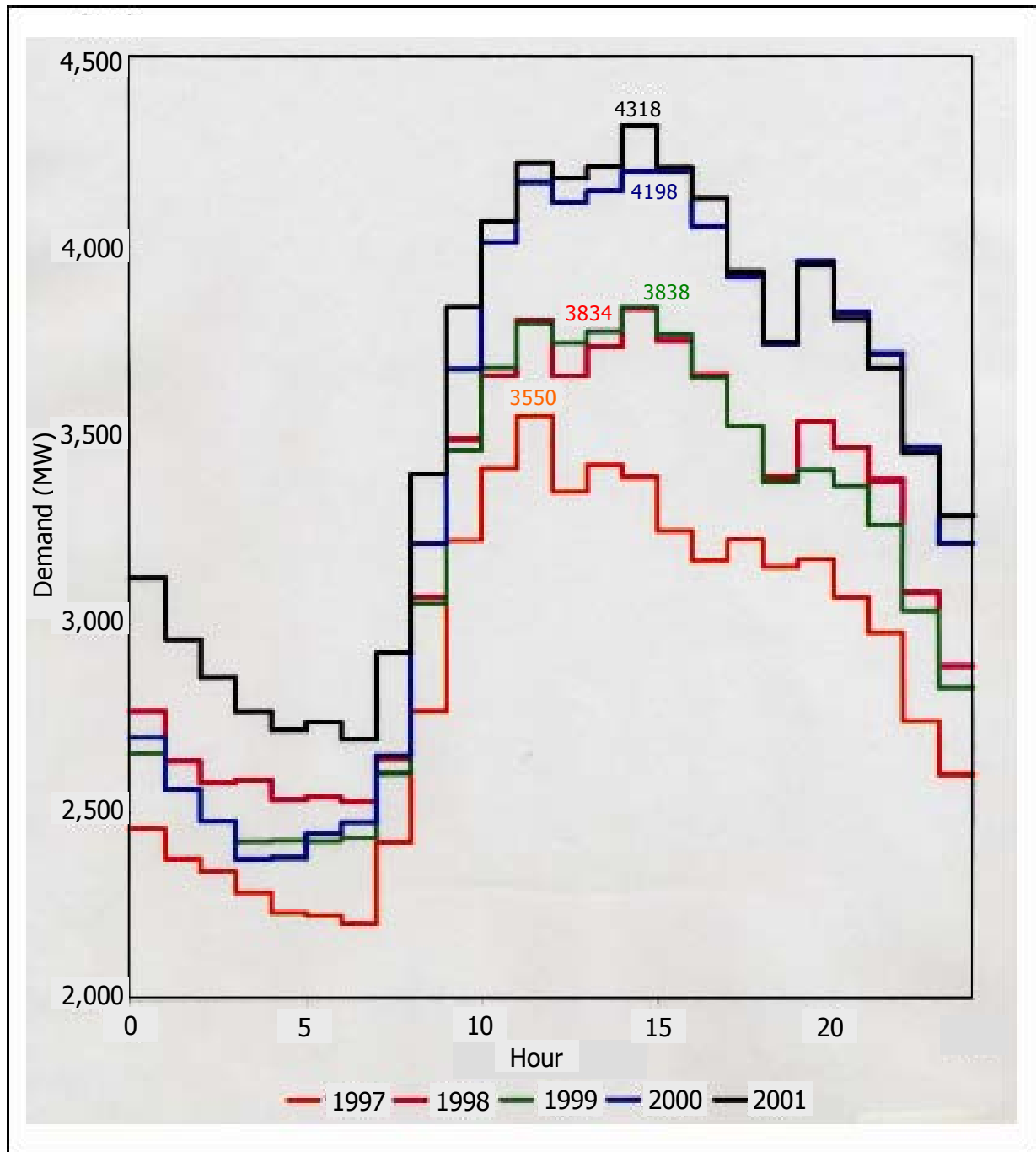
2. Japan (Whole Country)



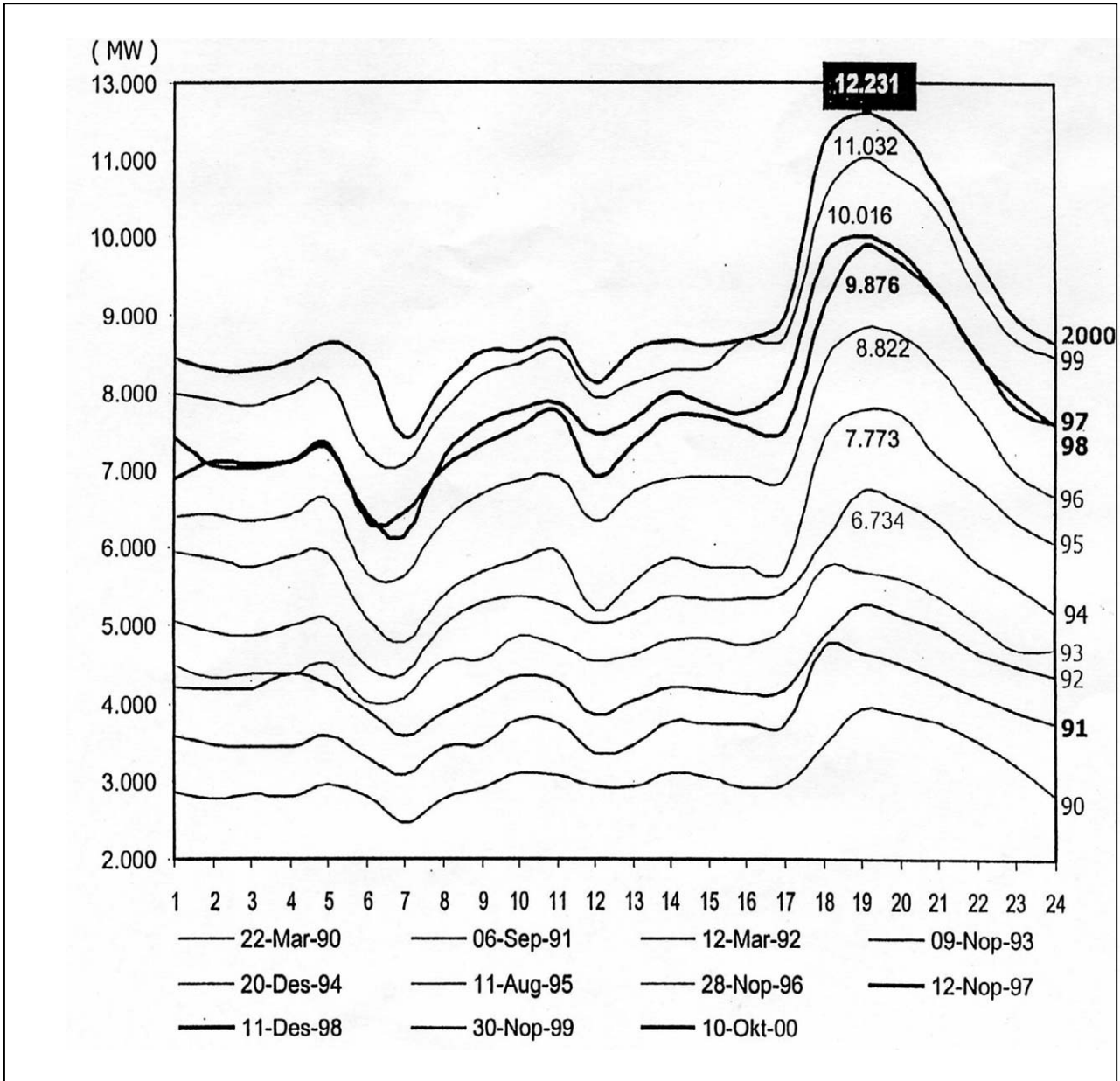
3. Malaysia (TNB)



4. Philippines (MERALCO)



5. Indonesia (PLN)



APPENDIX 3-3

Results of regression analysis

Appendix 3-3: Results of regression analysis

(Regression formula)

$$1 \text{ hr (MW)} = A_1X_1+B_1X_2+\dots+P_1X_{16}+C_1$$

$$2 \text{ hr (MW)} = A_2X_1+B_2X_2+\dots+P_2X_{16}+C_2$$

$$24\text{hr (MW)} = A_{24}X_1+B_{24}X_2+\dots+P_{24}X_{16}+C_{24}$$

(X_1, X_2, \dots, X_{16} ; Explanatory Variable)

(A_i, B_i, \dots, P_i ; Regression Coefficient @ i o'clock)

(Explanatory variables)

- 1) Population (mill)
- 2) GDP Agriculture (bill US\$)
- 3) GDP Industry (bill US\$)
- 4) GDP Service (bill US\$)
- 5) Temperature (deg)
- 6) Humidity (%)
- 7) GDP Total (bill US\$)
- 8) Electrified Population (mill)
- 9) 2nd order Population (mill)
- 10) 2nd order GDP Agriculture (bill US\$)
- 11) 2nd order GDP Industry (bill US\$)
- 12) 2nd order GDP Service (bill US\$)
- 13) 2nd order Temperature (deg)
- 14) 2nd order Humidity (%)
- 15) 2nd order GDP Total (bill US\$)
- 16) 2nd order Electrified Population (mill)

(The North Region)

Peak day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Const	707.83	541.29	273.68	189.64	2.8036	-1734	-318.7	-817	-434.2	-169.1	-1902	-799.3	314.98	1697.9	2790.5	3221.1	2519.3	339.49	424.49	1351	-559.2	-865.1	63.752	151.56
(1)	142.72	91.351	80.983	74.025	58	42.284	96.526	158.38	244.8	352.31	409.17	360.07	296.84	341.85	360.33	348.41	385.76	339.84	259.34	248.08	248.61	253.15	244.85	269.68
(2)	10458	10409	8277.6	9168.6	9950.5	9307.6	-176	21674	30907	40666	48155	38398	39707	43423	44160	48724	49169	35844	32845	30726	28058	19615	21816	17931
(3)	10964	10960	8740.7	9642.4	10385	9640.8	59.902	22168	31513	41156	48426	39024	40499	44091	44743	49201	49290	35871	32989	31026	28496	20193	22212	18298
(4)	10351	10306	8090.3	8972.5	9700.8	8948.9	-582	21365	30684	40344	47705	38356	39755	43335	43983	48420	48639	35175	32309	30330	27782	19513	21610	17858
(5)	-197.2	-179	-172.8	-170.2	-133.6	-65.48	-15.36	-68.27	-40.16	-21.04	-6.483	3.5989	-14.61	-49.61	-88.63	-117.6	-145.1	-34.7	-36.4	-111.2	-115.7	-132.1	-183.4	-157.8
(6)	14.077	21.227	27.605	31.086	27.466	57.599	-0.465	17.793	-11.89	-45.36	-19.71	-35.05	-51.73	-77.26	-96	-97.37	-72.46	-35.09	-38.01	-38.92	10.131	23.208	11.033	-2.388
(7)	-10507	-10490	-8288	-9181	-9919	-9179	373.16	-21608	-30893	-40517	-47839	-38453	-39878	-43463	-44113	-48570	-48766	-35364	-32486	-30503	-27957	-19670	-21742	-17921
(8)	-51.78	-20.37	-20.96	-17.14	-3.044	6.1357	-33.12	-61.68	-114.1	-159.5	-183.4	-171.2	-110.6	-168.1	-174	-168.7	-205	-174.1	-118.5	-111.2	-119.8	-129.6	-119.5	-134.3
(9)	-4.306	-3.042	-2.763	-2.616	-2.351	-2.107	-3.381	-4.806	-7.145	-10.37	-12.15	-10.35	-8.889	-9.853	-10.5	-10.28	-11.07	-9.904	-7.681	-7.273	-6.982	-6.705	-6.783	-7.108
(10)	-18.24	-15.09	-14.3	-12.82	-14.75	-14.64	-22	-27.57	-44.16	-62.97	-68.22	-57.47	-54.08	-62.67	-66.29	-69.73	-65.74	-49.44	-46.73	-42.27	-38.26	-26.14	-33.62	-24.19
(11)	-2.332	-2.061	-1.94	-1.847	-2.042	-1.957	-2.556	-3.55	-5.202	-6.699	-6.91	-6.144	-6.255	-6.894	-7.125	-7.352	-6.412	-4.879	-4.632	-4.375	-4.13	-3.172	-3.581	-2.598
(12)	-0.914	-0.673	-0.628	-0.527	-0.66	-0.567	-1.095	-1.565	-2.922	-4.103	-4.38	-3.968	-3.817	-4.366	-4.497	-4.704	-4.257	-2.981	-2.83	-2.557	-2.288	-1.505	-2.018	-1.353
(13)	4.9798	4.5859	4.4354	4.3597	3.4781	1.5526	0.4676	1.699	1.1285	0.7901	0.4616	0.338	0.733	1.3242	2.0153	2.567	2.8687	0.2953	0.8744	2.7361	3.0472	3.5577	4.7071	4.1987
(14)	-0.124	-0.169	-0.208	-0.232	-0.207	-0.394	-0.027	-0.136	0.0484	0.256	0.0988	0.1867	0.3	0.4568	0.5774	0.5902	0.4244	0.1659	0.2135	0.2113	-0.097	-0.182	-0.11	-0.027
(15)	0.6467	0.5287	0.4999	0.4517	0.5287	0.4885	0.7598	1.0588	1.7489	2.3696	2.4954	2.226	2.189	2.4747	2.5572	2.6684	2.3872	1.7409	1.6461	1.5085	1.3765	0.9583	1.1977	0.8187
(16)	3.8533	2.7613	2.6738	2.5686	2.3424	2.3496	3.6919	4.7075	6.9363	9.5233	11.036	9.6131	7.728	9.2312	9.7085	9.5123	10.602	9.8587	7.7423	7.2451	6.9671	6.5915	6.383	6.3972

Weekday	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Const	-682.4	-718.2	-984.9	-1158	-1523	-1413	-492	-949.3	-623.2	-735.7	-1328	-640.2	-122.6	943.24	1600.3	2413.9	2213.6	-128.2	856.91	1610.3	-2.688	-511.6	24.652	-294.3
(1)	139.09	86.356	75.971	68.81	53.054	35.584	91.578	151.23	236.71	341.73	398.77	353.65	289.12	331.07	350.19	340.83	381.81	324.44	250.09	241.96	238.83	242.71	236.64	267.92
(2)	11168	10380	10357	10162	10051	8303.3	-141.4	19483	33819	40628	50454	38223	39627	42444	46646	46196	45286	31101	31410	25870	26699	18115	20459	18370
(3)	11662	10931	10814	10634	10492	8646.1	87.11	19967	34426	41149	50756	38855	40433	43140	47261	46687	45386	31206	31529	26146	27128	18686	20840	18669
(4)	11064	10292	10176	9977.6	9819.8	7974.1	-537.4	19188	33611	40344	50042	38201	39700	42401	46517	45924	44760	30528	30870	25476	26438	18029	20263	18257
(5)	-171.9	-158.1	-149.7	-133.8	-98.49	-32.87	-15.72	-72.97	-44.69	-20.33	-14.99	-19.12	-34.93	-52.13	-67.4	-104.9	-72.41	53.133	-55.14	-134.6	-148.4	-164.6	-186.1	-157.9
(6)	43.566	49.175	54.825	56.548	58.066	42.838	4.4998	23.171	-3.621	-27.88	-27.02	-27.89	-29.62	-51.92	-67.71	-77.06	-86.28	-47.43	-39.35	-35.04	10.75	29.105	17.671	11.059
(7)	-11215	-10470	-10370	-10181	-10033	-8196	334.61	-19423	-33816	-40514	-50173	-38293	-39819	-42522	-46640	-46066	-44879	-30707	-31041	-25641	-26605	-18178	-20387	-18313
(8)	-53.31	-22.05	-21.69	-17.2	-3.423	6.5893	-35.12	-64.02	-115.5	-159.8	-183.8	-176.9	-115.6	-171.4	-176.5	-171.2	-204.2	-168.4	-121.2	-118.5	-125.6	-134.6	-124.8	-141.5
(9)	-4.2	-2.868	-2.623	-2.47	-2.183	-1.895	-3.217	-4.573	-6.896	-10.01	-11.8	-10.06	-8.559	-9.424	-10.09	-9.976	-10.99	-9.377	-7.433	-7.021	-6.622	-6.341	-6.487	-7.072
(10)	-17.51	-13.92	-13.51	-11.89	-13.63	-12.86	-20.94	-26.2	-42.94	-61.31	-66.53	-56.03	-52.63	-60.37	-64.03	-67.91	-64.62	-45.75	-45.72	-40.96	-36.61	-24.53	-32.1	-24.24
(11)	-2.241	-1.939	-1.852	-1.748	-1.935	-1.785	-2.435	-3.396	-5.079	-6.569	-6.779	-6.603	-6.128	-6.694	-6.934	-7.18	-6.268	-4.598	-4.497	-4.211	-3.95	-3	-3.406	-2.514
(12)	-0.87	-0.607	-0.582	-0.475	-0.6	-0.469	-1.034	-1.488	-2.853	-4.017	-4.291	-3.887	-3.738	-4.243	-4.377	-4.605	-4.19	-2.796	-2.766	-2.476	-2.193	-1.413	-1.929	-1.338
(13)	4.3168	4.0035	3.8013	3.4396	2.6008	0.7912	0.4308	1.7179	1.1418	0.6792	0.5394	0.6595	0.9961	1.2589	1.5192	2.2166	1.3786	-1.447	1.1625	3.1117	3.6094	4.0909	4.6089	4.0297
(14)	-0.304	-0.338	-0.373	-0.385	-0.395	-0.299	-0.049	-0.153	0.0057	0.156	0.1469	0.1475	0.1659	0.2991	0.3988	0.4649	0.513	0.2476	0.2185	0.1876	-0.103	-0.219	-0.154	-0.109
(15)	0.6176	0.4871	0.4705	0.4186	0.4913	0.4281	0.7204	1.0088	1.7065	2.3195	2.444	2.1769	2.1421	2.4013	2.4862	2.6077	2.342	1.632	1.6037	1.456	1.3165	0.9004	1.1404	0.8023
(16)	3.8203	2.6763	2.6092	2.4943	2.2458	2.2265	3.6218	4.601	6.8	9.279	10.8	9.4652	7.5386	8.965	9.4415	9.334	10.583	9.449	7.6458	7.1644	6.7964	6.4123	6.2586	6.4943

Holiday	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Const	-130.2	-177.9	-571.5	-624.9	-1410	-1026	-454.4	-736.3	-378.2	-506.2	-634.2	-185.2	67.504	1020.1	1973.8	2914.3	2547.4	-292.3	784.17	1573.7	110.88	-58.85	-108.1	302.59
(1)	137.38	83.652	72.058	63.37	46.583	17.126	73.685	112.27	190.07	292.68	347	318.2	256.3	283.56	301.12	294.53	342.87	292.33	227.9	216.96	217.25	219.19	219.73	253.87
(2)	12891	8788.6	10122	8646.1	9172.1	5031.3	-86.9	14440	21449	32467	38703	30578	30820	33646	34917	38019	39528	26507	24176	22013	20949	11737	19483	15989
(3)	13385	9338.8	10586	9130.9	9612.9	5395.1	132.55	14929	22095	33053	39104	31275	31619	34371	35586	38555	39672	26644	24281	22312	21393	12351	19874	16290
(4)	12792	8706.1	9956.1	8484.8	8962.4	4764.4	-419.8	14292	21438	32407	38532	30727	31028	33796	35004	37951	39187	26077	23732	21734	20779	11756	19356	15931
(5)	-184.6	-159.3	-148.3	-128	-82.15	-33.57	-1.851	-92.11	-63.01	-23.92	-4.396	-16.59	-29.03	-52.38	-58.33	-83.64	-29.65	78.295	-20.27	-116.9	-132.3	-142.4	-162.1	-141.3
(6)	33.361	35.264	43.367	41.447	50.498	35	4.2724	34.741	8.6752	-20.02	-35.01	-30.21	-27.65	-41.81	-66.7	-84.06	-98.55	-43.24	-44.48	-34.92	6.776			

(The Central Region)

Peak day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Const	-767.2	-1099	-1434	-1526	-1676	-3094	-942.2	-1083	-1916	-2781	-5226	-4485	-2940	-1738	-768.5	-393.2	-277.9	-1473	-2647	-2638	-3465	-3260	-2521	-2290
(1)	323.57	286.21	302.94	304.46	262.32	236.42	200.61	247.52	442.5	597.73	697.56	669.06	589.01	627.97	629.91	581.17	492.43	349.27	374.66	460.1	448.85	431.85	415.97	373.28
(2)	-7446	-5424	-6779	-6265	-6713	-2812	435.19	1443.1	-7137	-12269	-17119	-19123	-16406	-22948	-21790	-18090	-8612	1289.9	-5054	-10856	-14234	-9423	-11167	-11145
(3)	-6807	-4880	-6260	-5727	-6244	-2615	555.23	1638.1	-6481	-11517	-16437	-17975	-15178	-21453	-20388	-16933	-8373	878.99	-4968	-10422	-13466	-8689	-10558	-10362
(4)	-7000	-5099	-6426	-5908	-6485	-2909	130.12	1031.9	-6835	-11715	-16424	-17853	-15172	-21469	-20409	-17048	-8617	402.93	-5212	-10467	-13610	-8873	-10701	-10513
(5)	-163	-147.8	-138.7	-135.4	-100.8	-48.39	-30.8	-71.22	-33.82	-12.36	3.1332	14.691	-5.155	-41.88	-78.99	-100.4	-132.3	-36.89	-18.62	-82.09	-84.14	-109.9	-155.5	-144.8
(6)	10.501	19.845	23.046	25.676	25.912	53.271	0.139	6.689	-13.55	-28.12	7.2074	-2.363	-27.01	-44.61	-58.92	-55.49	-30.71	-0.024	6.1916	8.2104	34.951	41.616	35.509	34.946
(7)	7118	5185	6537.6	6012	6545.3	2918.3	-209.5	-1173	6933.8	11958	16795	18302	15567	21890	20826	17384	8754.6	-498.4	5306.9	10729	13832	9051.2	10880	10680
(8)	-121.7	-106.2	-114.7	-116.4	-93.03	-86.45	-81.08	-108.4	-184	-233	-262.8	-257.2	-191.3	-222.5	-218.1	-206	-221.1	-177.9	-143.1	-157.8	-160.3	-173.8	-165.5	-134.3
(9)	-8.717	-7.79	-8.185	-8.216	-7.291	-6.903	-6.044	-7.215	-12.23	-16.67	-19.54	-18.15	-16.34	-17.15	-17.42	-16.27	-13.96	-10.46	-10.87	-12.99	-12.27	-11.45	-11.2	-10
(10)	48.44	29.44	40.144	41.778	35.456	-0.312	-13.84	-46.3	31.798	63.324	93.354	134.82	109.47	164.53	158.91	129.88	27.791	-58.97	4.071	37.618	82.905	56.278	65.855	91.931
(11)	13.05	9.1705	11.424	11.398	10.097	3.3868	0.8633	-4.848	13.348	22.454	29.872	36.473	30.905	42.034	41.68	36.191	15.741	-2.847	9.9972	17.499	24.321	17.344	19.328	22.504
(12)	9.3372	6.3002	7.6505	7.679	6.9988	1.8581	0.7748	-3.106	9.647	15.539	20.21	25.112	20.887	29.269	28.801	25.045	10.676	-2.464	5.3567	9.0588	16.217	11.309	13.436	16.176
(13)	4.2279	3.8921	3.6726	3.5777	2.7355	1.1642	0.8054	1.7587	1.0042	0.6275	0.2901	0.1483	0.5733	1.2023	1.8553	2.2559	2.617	0.3223	0.4972	2.1155	2.3747	3.0763	4.0965	3.9031
(14)	-0.095	-0.154	-0.174	-0.193	-0.191	-0.363	-0.03	-0.069	0.0655	0.1618	-0.051	0.0047	0.1642	0.2763	0.37	0.3506	0.178	-0.046	-0.05	-0.068	-0.238	-0.287	-0.252	-0.249
(15)	-5.23	-3.641	-4.463	-4.473	-4.013	-1.289	-0.446	1.7303	-5.369	-8.797	-11.55	-14.19	-11.97	-16.45	-16.25	-14.11	-6.061	1.2442	-3.512	-6.094	-9.351	-6.645	-7.575	-8.944
(16)	6.4927	5.8637	6.1331	6.1817	5.5604	5.7019	5.5378	6.5679	9.9349	12.897	14.819	13.548	11.514	12.344	12.486	11.893	11.77	10.241	9.271	10.004	9.3879	8.9823	8.6314	7.3213

Weekday	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Const	-2219	-2430	-2750	-2937	-3259	-2852	-1159	-1290	-2155	-3384	-4679	-4374	-3415	-2554	-2016	-1274	-679.2	-2038	-2283	-2463	-2974	-2972	-2634	-2801
(1)	325.82	287.43	303.13	304.72	262.05	236.97	202.23	248.5	440.25	590.61	690.2	668.44	585.47	623.43	625.19	580.11	497.64	339.73	372.57	462.65	445.47	427.63	415.26	380.26
(2)	-7456	-5934	-7351	-7194	-6757	-2730	470.54	1284.6	-8090	-12763	-17630	-18764	-18068	-24651	-21850	-18215	-9134	589	-4823	-10995	-14023	-8979	-11568	-10591
(3)	-6843	-5401	-6847	-6667	-6289	-2537	567.55	1454.1	-7442	-11971	-16910	-17619	-16828	-23133	-20417	-17054	-8942	273.14	-4791	-10616	-13290	-8273	-11002	-9925
(4)	-7009	-5591	-6989	-6823	-6506	-2795	174.31	888.83	-7769	-12153	-16883	-17470	-16802	-23117	-20410	-17136	-9141	-170.5	-4998	-10618	-13395	-8421	-11103	-10030
(5)	-136.8	-125.7	-114.7	-98.04	-64.71	-14.49	-31.55	-75.31	-38.02	-11.36	-5.148	-7.713	-25.17	-43.81	-57.06	-86.69	-58.21	53.075	-36.41	-104.3	-115.7	-141.4	-157.1	-144.5
(6)	40.236	48.18	50.553	51.489	56.853	38.521	5.138	12.311	-5.143	-10.36	0.0458	4.9058	-4.75	-18.99	-30.31	-34.8	-44.22	-11.46	4.9449	12.27	35.731	47.719	42.313	48.183
(7)	7138.3	5689.8	7111	6938.2	6577.4	2820.4	-240.4	-1013	7879.5	12405	17263	17932	17206	23553	20841	17488	9297.3	95.198	5106.1	10896	13632	8612.8	11298	10211
(8)	-127	-111.6	-118.7	-119.7	-96.23	-90.4	-87.29	-115.8	-188.8	-234.6	-264.4	-266.3	-198.5	-229.3	-223.6	-212.4	-226.3	-174.4	-151.2	-171.2	-171.1	-183.3	-176.4	-148.7
(9)	-8.748	-7.76	-8.166	-8.197	-7.231	-6.858	-6.032	-7.169	-12.11	-16.38	-19.26	-17.99	-16.1	-16.86	-17.13	-16.11	-14.09	-10.06	-10.79	-12.94	-12.06	-11.23	-11.08	-10.17
(10)	47.943	30.174	40.311	42.411	36.44	0.9485	-13.89	-45.69	32.837	67.513	97.094	136.1	111.61	167.91	162.46	131.69	26.164	-50.59	1.7912	35.494	81.845	55.808	64.424	85.354
(11)	12.974	9.2745	11.451	11.5	10.228	3.5365	0.8442	-4.75	13.498	23.909	30.414	36.642	31.201	42.497	42.163	36.425	15.471	-1.634	9.5889	17.11	24.053	17.184	19.024	21.458
(12)	9.2008	6.2999	7.6031	7.6857	7.0397	1.8796	0.6728	-3.14	9.6869	15.989	20.595	25.169	21.066	29.55	29.109	25.142	10.343	-1.597	4.9458	8.6433	15.925	11.104	13.102	15.246
(13)	3.545	3.2833	3.0186	2.6349	1.8361	0.3735	0.7771	1.7647	1.0111	0.5112	0.3642	0.4643	0.8312	1.1265	1.3467	1.8861	1.1004	-1.462	0.7654	2.4658	2.9135	3.5858	3.9733	3.7223
(14)	-0.277	-0.326	-0.34	-0.348	-0.382	-0.269	-0.052	-0.088	0.0221	0.0604	-0.004	-0.035	0.0293	0.1172	0.1897	0.2231	0.2647	0.0311	-0.046	-0.093	-0.245	-0.326	-0.296	-0.329
(15)	-5.179	-3.663	-4.457	-4.495	-4.051	-1.326	-0.415	1.7193	-5.411	-9.047	-11.76	-14.24	-12.08	-16.62	-16.43	-14.18	-5.918	0.7647	-3.319	-5.904	-9.219	-6.558	-7.424	-8.843
(16)	6.5753	5.8941	6.167	6.2081	5.5492	5.7133	5.5952	6.614	9.9051	12.694	14.62	13.505	11.394	12.182	12.307	11.833	11.937	9.8986	9.3314	10.108	9.3572	8.9345	8.6681	7.6308

Holiday	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Const	-1692	-1919	-2376	-2453	-3230	-2624	-1285	-1474	-2323	-3568	-4347	-4205	-3629	-2974	-2178	-1336	-872.1	-2620	-2751	-2846	-3141	-2765	-2989	-2394
(1)	326.31	287.18	302.21	302.96	263.13	232.27	208.52	255.94	443.5	592.08	681.98	666.75	598.73	628.07	628.14	585.09	504.58	343.12	385.42	467.03	448.27	424.38	417.89	383.21
(2)	-7453	-5214	-6751	-7284	-7101	-2558	-539.3	1373.6	-7706	-13433	-17130	-18818	-17184	-23546	-22470	-19254	-6840	912.48	-3543	-10686	-13523	-10116	-11488	-10834
(3)	-6844	-4685	-6243	-6745	-6649	-2368	-518.2	1425.3	-7140	-12687	-16399	-17675	-16078	-22129	-21102	-18169	-6713	544.62	-3624	-10353	-12832	-9403	-10958	-10210
(4)	-6999	-4863	-6371	-6882	-6828	-2553	-785.5	1107.7	-7196	-12595	-16129	-17342	-15806	-21832	-20816	-17976	-6666	292.62	-3642	-10195	-12806	-9442	-10956	-10223
(5)	-149	-126.4	-112.5	-91.26	-46.97	-12.49	-18.89	-90.97	-53.4	-12.22	7.9407	-3.097	-15.89	-38.89	-41.3	-57.24	-6.866	85.387	5.0761	-80.56	-94.84	-114.7	-129.3	-124.6
(6)	30.162	34.427	39.37	36.75	49.692	31.548	4.9974	24.533	7.74	-1.901	-7.316	3.1248	-2.035	-7.372	-27.22	-39.36	-54.09	-5.273	1.4424	14.07	33.07	35.617	42.936	31.441
(7)																								

(The South Region)

Peak day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Const	-507.6	-439.7	-771.6	-982.9	-1139	-2458	-1133	-444.7	-678.4	-683	-2627	-1742	-508.7	963.81	1875.5	2279.2	1815.1	-1.755	57.654	835.54	-1354	-1387	-397.6	426.12
(1)	344.67	304.56	311.18	298.73	262.21	220.38	248.48	322.27	476.34	557.85	604.71	574.93	509.42	543.37	542.29	511.17	465.32	365.27	328.22	336.29	418.44	417.4	424.1	361.12
(2)	-9284	-7683	-9298	-8050	-7682	-5391	-694.7	-4841	-9200	-8429	-6606	-9973	-8223	-8052	-6166	-4931	-1949	87.402	-838.3	-878.8	-5979	-7410	-5698	-2680
(3)	-9183	-7547	-9239	-7963	-7622	-5427	-720.9	-4675	-8876	-8155	-6480	-9559	-7711	-7646	-5842	-4703	-2024	-44.06	-948	-882.1	-5900	-7254	-5667	-2733
(4)	-9368	-7775	-9437	-8179	-7885	-5763	-1132	-5227	-9304	-8585	-6822	-9786	-8026	-8006	-6230	-5148	-2483	-652.9	-1470	-1375	-6266	-7604	-5934	-3004
(5)	-173.3	-155	-146.9	-143	-107.6	-51.16	-34.62	-73.66	-39.16	-17.79	-0.887	11.899	-6.708	-38.15	-72.73	-98.62	-136.3	-37.8	-28.87	-100.1	-103.6	-125.5	-171.2	-165.9
(6)	0.2	0.1054	5.1407	12.489	11.839	38.976	-1.807	-20.51	-46.93	-69.39	-36.68	-51.25	-71.35	-97.74	-110.2	-108.6	-73.27	-32.73	-45.32	-47.18	-5.736	2.1993	-13.99	-27.3
(7)	9434.4	7811.9	9477.4	8210.3	7887	5717.3	1047.7	5119.3	9322.6	8629.1	6906.3	9935.4	8137.8	8092.8	6298.8	5176.8	2453.6	505.55	1365	1295.6	6273	7614.3	5975.9	3012.5
(8)	-164.2	-139.6	-148.5	-141.9	-117.6	-91.93	-113.6	-144.3	-232.3	-266.3	-285.6	-288	-226.1	-279.3	-276.1	-260.6	-250	-187.2	-160.2	-164.7	-211.2	-218.5	-217.3	-185.3
(9)	-9.356	-8.381	-8.495	-8.178	-7.401	-6.633	-7.334	-9.236	-13.03	-15.46	-16.87	-15.48	-14.08	-14.75	-14.89	-14.22	-13.07	-10.68	-9.486	-9.55	-11.34	-11.04	-11.38	-9.785
(10)	11.31	16.133	21.03	22.327	16.568	10.118	-1.414	-7.648	-6.287	-26.82	-30.56	-17.05	-17.46	-27.74	-35.15	-42.52	-55.1	-50.09	-41.01	-33.93	-15.17	-7.325	-9.155	-22.28
(11)	6.1786	6.5151	7.4645	7.5327	6.4627	5.2049	2.836	2.281	4.5445	2.4321	2.2577	3.8291	3.1875	1.7875	0.7553	-0.368	-2.853	-3.665	-2.254	-1.231	2.9348	3.1811	3.3289	-0.215
(12)	5.1682	5.4814	6.1497	6.2202	5.433	4.5779	2.8977	2.7632	4.2717	2.5964	2.3353	3.2645	3.0234	1.923	1.1768	0.3105	-1.752	-2.17	-1.204	-0.398	2.793	3.0459	2.9772	0.3015
(13)	4.4513	4.0538	3.8584	3.751	2.8928	1.2311	0.9011	1.8225	1.1199	0.7376	0.3663	0.1972	0.5984	1.124	1.7293	2.2171	2.6987	0.3527	0.721	2.5058	2.792	3.4166	4.4484	4.3783
(14)	-0.035	-0.036	-0.067	-0.114	-0.107	-0.276	-0.024	0.0956	0.2643	0.4066	0.2079	0.2927	0.4252	0.586	0.6679	0.6618	0.4316	0.1526	0.2591	0.2632	0.0028	-0.052	0.0437	0.1228
(15)	-2.689	-2.842	-3.208	-3.242	-2.812	-2.326	-1.4	-1.277	-2.151	-1.272	-1.16	-1.726	-1.548	-0.962	-0.55	-0.08	1.007	1.2903	0.7423	0.3096	-1.4	-1.529	-1.529	-0.088
(16)	7.8088	6.976	7.164	6.9129	6.309	5.9064	6.7797	8.1393	11.36	13.331	14.518	13.473	11.685	13	13.113	12.581	12.164	10.465	9.2645	9.1569	10.353	10.012	10.008	8.6556

Weekday	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Const	-1943	-1747	-2068	-2372	-2702	-2201	-1334	-613.8	-886.4	-1248	-2056	-1597	-951.2	184.84	657.39	1428.7	1433.9	-529.9	430.8	1027.3	-851.2	-1083	-500.1	-88.01
(1)	344.36	303.79	309.5	297.08	260.82	218.16	247.84	320.98	472.8	552.1	598.31	573.51	506.48	538.98	538.1	509.09	465.35	357.11	323.11	335.59	414.21	412.41	421.24	362.89
(2)	-8403	-7428	-8999	-7876	-8617	-5517	-655.4	-6202	-8529	-7195	-8885	-9091	-8946	-7430	-6220	-4541	-2558	-1326	-1352	-1682	-8103	-6336	-5817	-3021
(3)	-8316	-7298	-8949	-7795	-8556	-5549	-693.5	-6052	-8210	-6901	-8738	-8681	-8429	-7009	-5878	-4310	-2654	-1395	-1492	-1716	-8041	-6196	-5809	-3142
(4)	-8478	-7500	-9127	-7990	-8798	-5853	-1078	-6568	-8614	-7314	-9065	-8884	-8724	-7339	-6237	-4724	-3076	-1970	-1982	-2170	-8371	-6512	-6038	-3375
(5)	-146.8	-132.7	-122.8	-105.6	-71.5	-17.14	-35.04	-77.68	-43.38	-16.97	-9.302	-10.58	-26.82	-40.16	-50.81	-84.96	-62.23	51.796	-46.27	-121.9	-134.8	-156.6	-172.3	-164.6
(6)	29.957	28.188	32.475	38.09	42.491	24.321	3.1512	-15.37	-39.05	-52.85	-44.69	-44.7	-50.04	-73.1	-82.51	-88.52	-86.26	-45.4	-46.28	-43.01	-5.153	7.9991	-7.136	-13.1
(7)	8554	7547.8	9175.8	8030	8808.6	5821.7	1004.1	6475.1	8643	7366.9	9157	9043.1	8845.2	7439.7	6319.5	4766.2	3061.6	1840.7	1889	2105.6	8392.9	6535.9	6095.1	3396.5
(8)	-167.7	-143.9	-151.3	-144.2	-120.2	-94.28	-118.3	-150.3	-236.5	-269.5	-288.5	-296.8	-234	-286.6	-282.4	-266.5	-251.6	-186.1	-165.4	-175.3	-220.5	-226.9	-226	-194.7
(9)	-9.321	-8.3	-8.429	-8.111	-7.313	-6.518	-7.264	-9.132	-12.89	-15.22	-16.61	-15.31	-13.87	-14.47	-14.62	-14.04	-13.06	-10.32	-9.328	-9.418	-11.11	-10.8	-11.21	-9.818
(10)	12.78	18.161	22.512	23.995	18.368	12.812	0.5452	-5.087	-4.234	-24.47	-28.36	-14.78	-15.32	-24.45	-31.99	-39.72	-52.96	-45.3	-39.13	-31.52	-12.52	-4.748	-6.586	-21.32
(11)	6.4341	6.8303	7.7074	7.7968	6.7268	5.5981	3.156	2.6983	4.8591	2.7268	2.5278	4.1667	3.4854	2.2348	1.1717	0.0356	-2.473	-3.104	-1.912	-0.809	3.3532	3.5831	3.7509	0.0829
(12)	5.329	5.6838	6.3048	6.3894	5.6036	4.8305	3.1002	3.0268	4.4756	2.7977	2.5206	3.4859	3.2225	2.2191	1.4537	0.5721	-1.519	-1.79	-0.993	-0.135	3.0553	3.3	3.2405	0.4689
(13)	3.7633	3.4425	3.2017	2.8064	1.9922	0.4377	0.8655	1.8276	1.1275	0.625	0.443	0.5149	0.8582	1.05	1.2208	1.8481	1.1823	-1.424	0.9813	2.8467	3.3229	3.9197	4.3156	4.1761
(14)	-0.216	-0.206	-0.233	-0.268	-0.296	-0.183	-0.046	0.08	0.2241	0.3125	0.2603	0.2574	0.2962	0.4328	0.493	0.5378	0.5154	0.2366	0.262	0.238	-0.003	-0.089	-9E-04	0.037
(15)	-2.782	-2.959	-3.297	-3.34	-2.91	-2.472	-1.517	-1.43	-2.268	-1.387	-1.265	-1.853	-1.661	-1.132	-0.709	-0.231	0.8702	1.0734	0.6193	0.1565	-1.553	-1.677	-1.682	-0.189
(16)	7.8311	6.9657	7.1576	6.9009	6.2766	5.8604	6.7843	8.1361	11.308	13.185	14.364	13.421	11.592	12.859	12.964	12.505	12.203	10.198	9.2384	9.1706	10.285	9.9351	9.9782	8.8015

Holiday	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Const	-1410	-1227	-1681	-1871	-2655	-1934	-1393	-711.6	-936.7	-1302	-1596	-1317	-1026	-63.85	663.27	1517.7	1357.8	-1030	21.891	707.52	-966.7	-825	-817.3	342.33
(1)	343.9	302.49	307.76	294.53	258.99	209.86	244.27	310.49	459.38	537.51	579.08	562.99	502.21	525.74	523.49	495.92	455.97	348.42	321.72	330.03	408.51	403.38	416.7	359.2
(2)	-8494	-7199	-9643	-7826	-8038	-5676	-1646	-7420	-11311	-10434	-9013	-11704	-10571	-10816	-9096	-7345	-5101	-2853	-3234	-2611	-7627	-9143	-6999	-3122
(3)	-8407	-7070	-9590	-7736	-7982	-5700	-1707	-7295	-10993	-10117	-8813	-11263	-10090	-10405	-8740	-7106	-5187	-3217	-3405	-2643	-7567	-8979	-6993	-3250
(4)	-8561	-7263	-9753	-7914	-8191	-5938	-1981	-7593	-11154	-10283	-8916	-11297	-10169	-10483	-8849	-7275	-5391	-3320	-3730	-2955	-7781	-9195	-7130	-3402
(5)	-159	-133.4	-120.6	-98.89	-53.57	-14.93	-21.14	-92.52	-58.27	-17.58	3.7438	-6.134	-17.91	-36.1	-36.05	-56.2	-10.86	84.71	-3.558	-97.28	-113.3	-129.6	-143.9	-144.1
(6)	19.896	14.421	21.118	23.091	35.385	16.966	2.9766	-2.022	-26.01	-44.68	-53.2	-47.54	-47.2	-62.03	-79.97	-93.19	-95.95	-39.09	-48.76	-41.06	-7.627	-4.41	-6.222	-29.31
(7)	8640.6	7314.5	9808.6	7961.7	8215.7	5936.1	1954.1	7593.5	11288	10445	9													

APPENDIX 3-4

Results of daily load curve forecasts

Appendix 3-4: Results of daily load curve forecasts

Figure-1: Monthly load curve forecasts by type (regional)

Figure-2: Forecasts of yearly generation and peak demand (regional)

Figure-3: Forecasts of load factor and monthly generation/peak demand (regional)

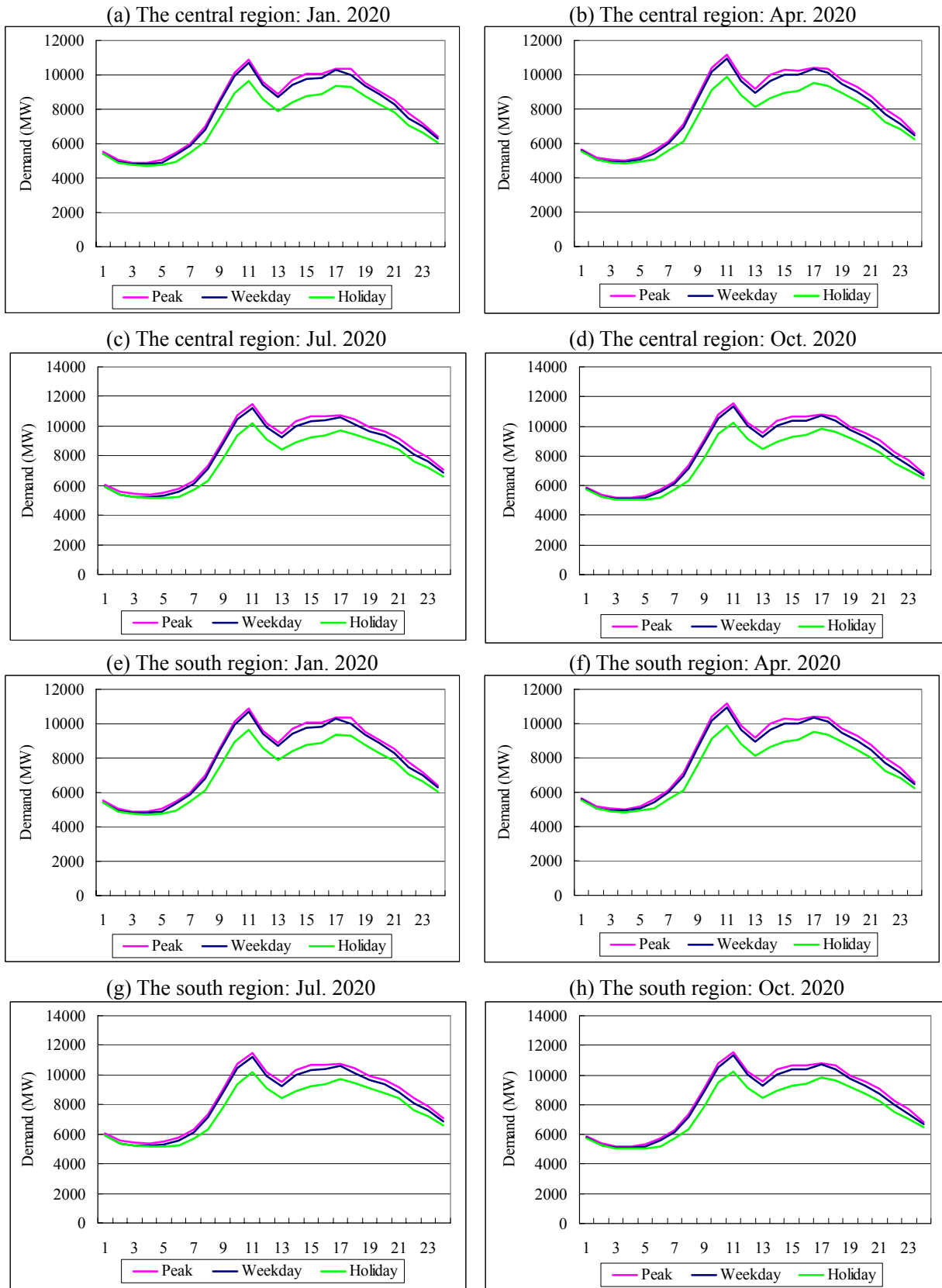


Figure-1: Monthly load curve forecasts by type (regional)

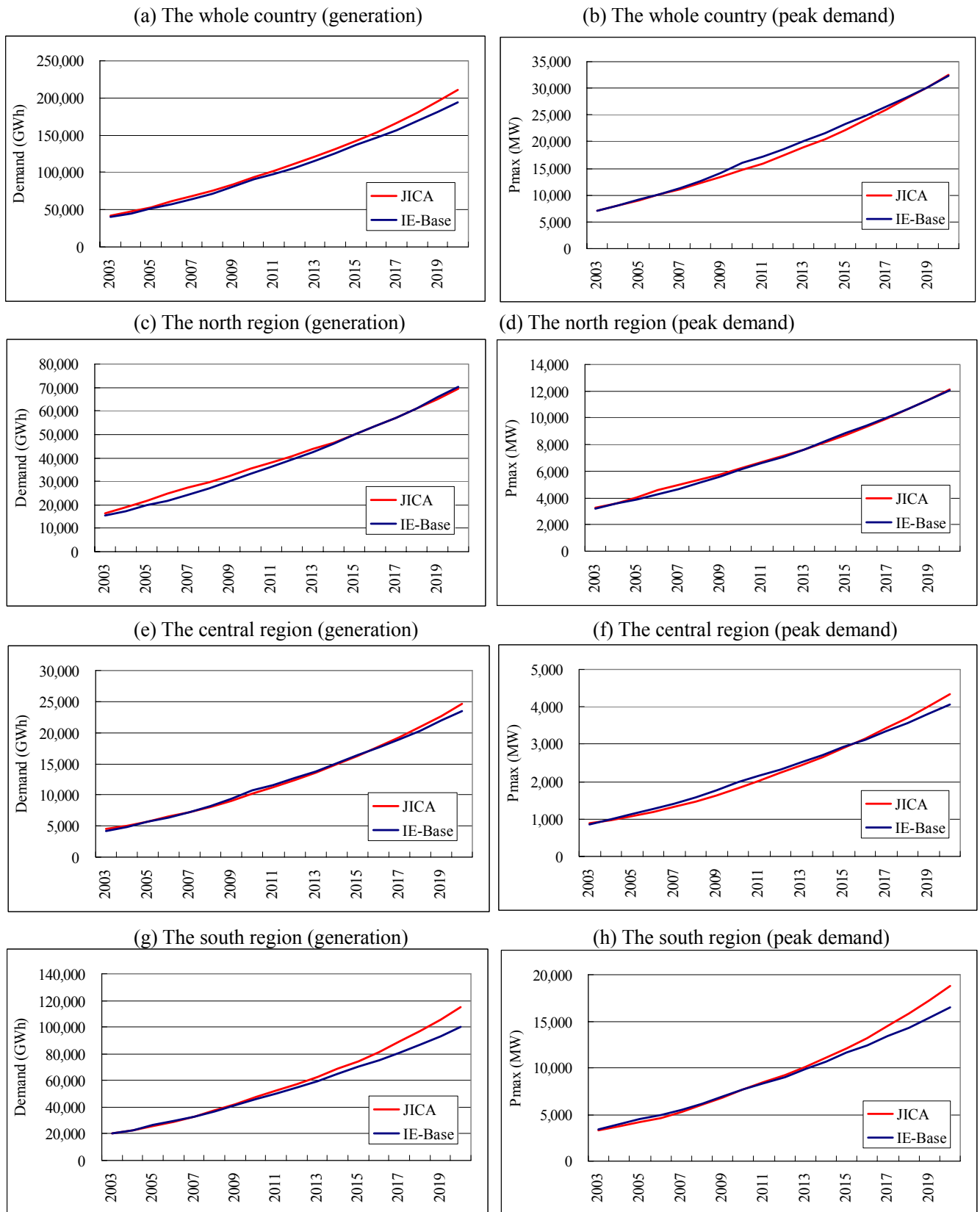
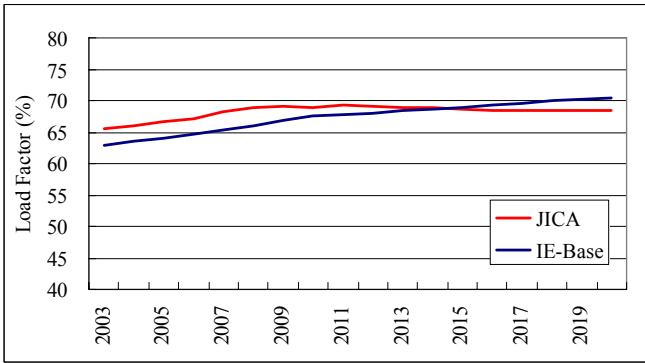
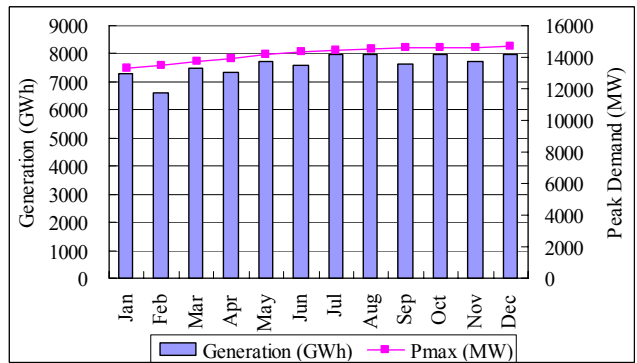


Figure-2: Forecasts of yearly generation and peak demand (regional)

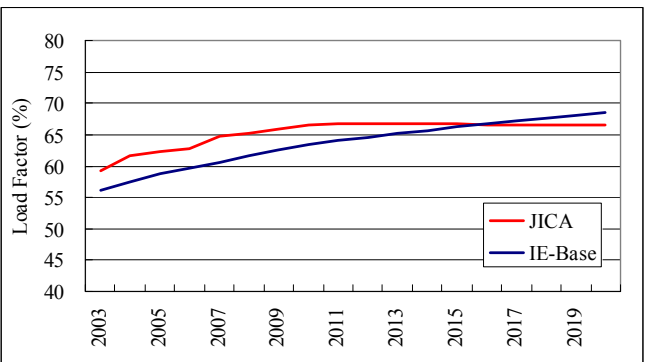
(a) The whole country (load factor)



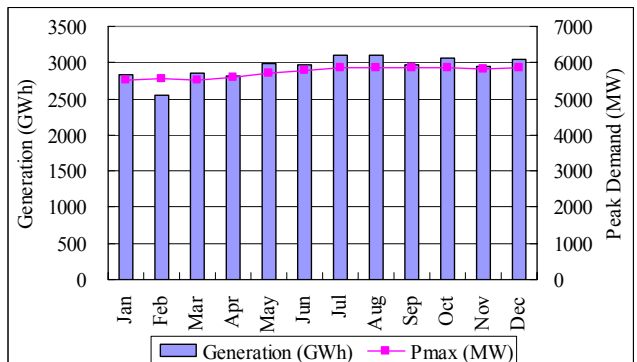
(b) The whole country (monthly demand in 2010)



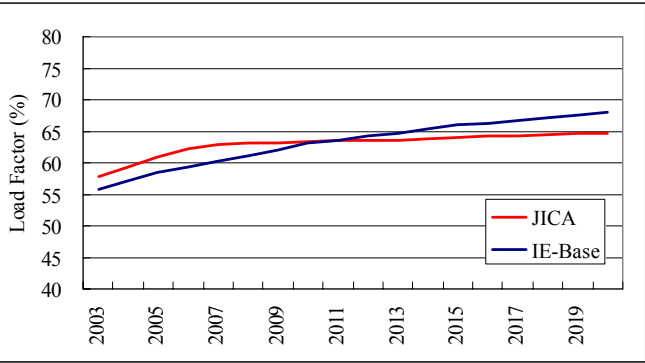
(c) The north region (load factor)



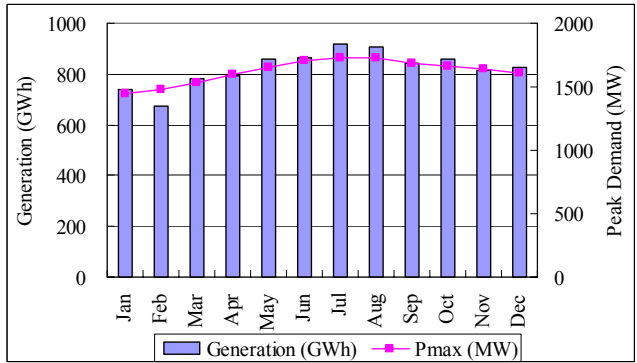
(d) The north region (monthly demand in 2010)



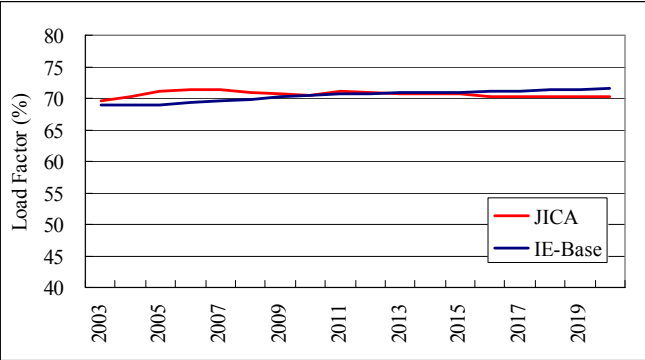
(e) The central region (load factor)



(f) The central region (monthly demand in 2010)



(g) The south region (load factor)



(h) The south region (monthly demand in 2010)

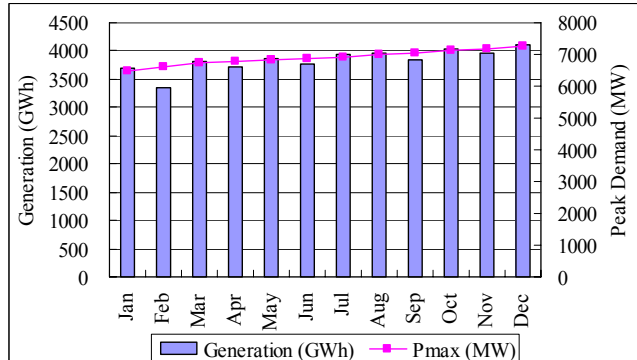


Figure-3: Forecasts of load factor and monthly generation/peak demand (regional)